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CONTENTS

PAGE

NATURAL RUBBER—ITS POSITION AND PROSPECTS ... ...
by E. D. C. Baptiste 99

INVESTIGATIONS ON THE EFFECTS OF COPPER DUSTS USED TO CONTROL PHYTOPHTHORA LEAF DISEASE ... ...
PART II—REMOVAL OF COPPER FROM SCRAPS ... ...
by K. F. Heinisch, M. Nadarajah and M. T. Veerabangsa 103

HISTORY AND DESCRIPTION OF PROMISING RRIC CLONES ...
by C. A. de Silva and R. Satchuthananthavale 112

PLANTING TOPICS 129

QUESTION CORNER 131

MINUTES OF THE 174th and 175th MEETINGS OF THE RUBBER RESEARCH BOARD ... 133

NOTICES

DARTONFIELD GROUP—VISITORS' DAY

Those who wish to visit the Institute are requested to do so after making an appointment. No special days are set apart as Visitors' Days and the services of the technical officers can be availed of for discussion or demonstration only by prior appointment.

PUBLICATIONS

Rubber Research Institute publications comprising Annual Reports, Quarterly Journals and occasional Bulletins and Advisory Circulars are available without charge to the Proprietors (resident in Ceylon), Superintendents and Local Agents of rubber estates in Ceylon over 30 acres in extent. Advisory Circulars and Smallholdings Folders in English or Sinhala will be available without charge to smallholders on application. Forms of application can be supplied on request.

It will be appreciated if subscribers will return any back publications which are of no use to them.

ADVISORY CIRCULARS

The undernoted Advisory Circulars may be obtained on application at 30 cents per copy. Future issues in the series will be sent free of charge to estates and smallholders registered for the receipt of our publications:—

(5) Straining box for latex (January, 1940).

(12) Warm Air Drying House for Crepe Rubber (Reprinted 1952).

(33) Mechanical Felling of Rubber Trees (Reprinted March, 1955).

(37A) Manuring—Magnesium Deficiencies in Rubber (July, 1954).

(37B) Potassium Deficiencies (September, 1954).

(38) Planting and After-Care of Budded Stumps and Stumped Budgrafts (Superseding Advisory Circular No. 8) (March, 1953).

(39) Clonal Seed as Planting Material (Superseding Advisory Circulars No. 26 and 27) (July, 1953).

(41) Pink Disease (June 1954).

(44) Diplodia Dieback and Collar Rot of Hevea and Blue Spot of Crepe Rubber (June, 1954).

(47) Ustulina Rot of Rubber Trees (November, 1954).

(49) Root Disease in Replanted Areas (Superseding Advisory Circular No. 31) (October, 1951).

(50) Orange Gall of Hevea (December, 1954).

(51) Bird's Eye Leaf Spot of Hevea (December, 1954).

(56) Cover Crops (Superseding Advisory Circular No. 25) (October, 1955).

(57) Notes on Rubber Seedling Nurseries (Superseding Advisory Circular No. 35) (October, 1955).

(58) Notes on Budgrafting Procedure (Superseding Advisory Circular No. 1) (December, 1955).

(60) Sale of Budwood (Superseding Advisory Circular No. 42) (June, 1958).

(61) Prevention of Coagulation in the Field (Superseding Advisory Circular No. 53) (September, 1958).

(62) The White Root Disease of Hevea—Fomes Lignosus (Superseding Advisory Circular No. 46) (October, 1958).

(63) Brown Root Disease of Hevea—Fomes Noxius (Superseding Advisory Circular No. 48) (December, 1958).

(64) Bark Rot and Canker of Hevea—Phytophthora Palmivora (Superseding Advisory Circular No. 54) (December, 1958).

(65) The Phytophthora Leaf Disease of Hevea—Phytophthora Palmivora (Superseding Advisory Circular No. 45) (December, 1958).

(66) Manuring of Rubber (Superseding Advisory Circulars No. 59 & 59A) (April, 1959).

(67) A Simple Method of Control of Latex Coagulation. (February, 1960).

(68) Minor Pests of Rubber Plantations (June, 1960).

(69) Defects in Smoked Sheet. (September, 1960).

(70) Oidium Leaf Disease (Superseding Advisory Circular No. 43). *In preparation.*

(71) Tapping of Hevea Rubber (Superseding Advisory Circular No. 40). (November, 1961).

NATURAL RUBBER—ITS POSITION AND PROSPECTS

By

E. D. C. Baptiste

The production of synthetic rubbers, each with its specific properties technically superior for certain purposes to those of natural rubber, has resulted in the gradual displacement of natural rubber in a number of fields where, for example, resistance to heat, oils or petrol and impermeability to air are of primary importance.

These "tailor made" synthetic products, of which the most important are butadiene-styrene copolymers (SBR formerly known as GRS), butadiene-acrylonitrile copolymers, butyl rubber and neoprene are not true synthetic rubbers as their molecular configuration bears little resemblance to that of natural rubber, but are rubber-like synthetic elastomers.

The rapid progress of polymerisation research during the last decade has, however, made possible the synthesis from isoprene, a by-product of the petroleum industry, of a material, cis-polyisoprene, a true synthetic rubber almost identical chemically and structurally with natural rubber which it can replace in almost every application where natural rubber is used.

In the same way polymerisation of butadiene has produced a synthetic rubber, cis-polybutadiene, which, although difficult to process, possesses a higher resilience and lower heat generation than natural rubber making it superior to the latter for use in heavy duty tyres for which purpose natural rubber had until then been unrivalled.

These two new synthetic rubbers, known as stereo-regular or stereo-specific rubbers, present a serious threat to natural rubber.

The new cis-polyisoprene rubber is being manufactured under the following trade names: "Coral rubber" of Firestone Tire & Rubber Co., "Ameripol SN" of Goodrich-Gulf Chemicals Inc., "Natsyn" of Goodyear Tire & Rubber Co. and Cariflex 1R of Shell Chemicals. This rubber is also being produced by Phillips Chemical Co. and other American rubber companies.

In the Soviet Union it is manufactured under the code name "Ski."

According to an American authority on the subject "These new stereo rubbers have altered the invulnerable position of the natural product. It is no longer a question of whether synthetic can be used in its place to give adequate quality, the question now is simply one of economics".

It is expected, however, that for some time to come natural rubber may retain an advantage in cost of production over the new stereo-regular rubbers, although it cannot be ruled out that new manufacturing processes may appreciably reduce the cost of production of the latter.

The blending of natural rubber with the synthetic products, both elastomers and plastics, may open up a wide field of use for natural rubber, especially as rubber

consumption in the U.S.A. is already in the proportion of 75% synthetic and 25% natural.

The time is fast approaching when the demand for natural rubber will be determined by the ability of the industry to produce it at a price competitive with that of the synthetic product and the most important contributory factor to a low cost of production is a high rate of productivity.

This can be achieved by modernization of estates and the use of the most efficient techniques both in the field and in the factory.

What is being done towards that end?

Rejuvenation of estates and of smallholdings by means of a progressive rate of replanting with high-yielding material is clearly essential if full competitive power is to be available against the new synthetic products, although the expenditure involved can give no return for six or seven years.

Subsidized replanting is the order of the day both in Malaya and in Ceylon.

In Malaya the total production of rubber from estates and smallholdings is expected to increase from 710,500 tons in 1960 to 1,049,000 tons in 1970, brought about by replanting with high-yielding material which in 1970 is expected to amount to 87% of the total planted acreage on estates and to 70% of that on smallholdings.

For Ceylon the total acreage replanted under the Government-sponsored Rubber Replanting Subsidy Scheme for the ten-year period 1953 to 1962 is expected to be approximately 200,000 acres, or over 30% of the total rubber acreage of 668,950 acres.

The acreage replanted up to the end of 1961 was 169,729 acres.

This rate of replanting, measured as a percentage of the total rubber acreage, is the highest in any rubber growing country in the world and reflects great credit on the Rubber Replanting Advisory Board and more especially on its Chairman, the Rubber Controller, on the staff of the Rubber Control Department and, last but not least, on the staff of the Smallholdings Department of the Rubber Research Institute who have been responsible for advice and practical help to smallholders in all stages of replanting operations carried out under the Rubber Replanting Subsidy Scheme.

The replanted areas when they come into bearing are expected to increase Ceylon's total rubber production by over sixty per cent.

Production and Consumption research is being intensified. The recent reorganization of rubber research in Malaya and abroad under the control of the Malayan Rubber Fund Board which has as objectives "the production of natural rubber at reduced cost and the retention and improvement of quality in the product presented for sale in the overseas market" augurs well for the future.

The efforts of the International Rubber Research and Development Board, of which the Rubber Research Institute of Ceylon is an active member, in providing technical services to consumers of natural rubber, in co-ordinating on an international basis research carried out in its member countries will go a long way in avoiding duplication of effort and in ensuring collaboration for the common benefit of rubber growing countries which, with the advent of the new stereo-regular rubbers, now face a more serious competitive situation than any experienced so far.

These new synthetic rubbers have now reached the stage of commercial manufacture. The production in 1960 was 45,000 tons and is expected to increase to 200,000 tons in 1961 and in 1962 to 230,000 tons or about one ninth of the world production of natural rubber.

The advantage still possessed by natural rubber is that it can be marketed profitably in competition with, and that it has an **overall** technical superiority to, any synthetic rubber substitute, although it may be inferior to some in respect of some properties, as for instance to butyl rubber in respect of permeability to gases and heat resistance.

A distinguished pioneer in the development of synthetic rubber recently said "I have always looked upon natural rubber as the great model substance which with respect to some properties might be surpassed but hardly duplicated as regards the totality of its wonderful properties".

There is, however, the need to improve standards of cleanliness, of grading and of packing of natural rubber to obtain uniformity of quality (an important advantage of synthetic rubber) and to conform to the internationally agreed standards of the various grades, as specified in the publication "Type Descriptions and Packing Specifications for Natural Rubber Grades in International Trade", known as the "Green Book", since, other things being equal, an unsatisfactory or unpredictable product may tip the scales in favour of the uniform synthetic rubber in a competitive market.

The growing world demand for rubber cannot be met by natural rubber alone and must be supplied by the synthetic product.

The world production of natural rubber in 1960 was 2 million tons whereas the total rubber consumption amounted to 3.8 million tons. For 1970 the production of natural rubber is estimated at 2.4 million tons and the world rubber consumption at about 5 million tons.

The general trend, therefore, is to regard synthetic and natural rubber as complementary rather than competitive and that there should be more co-operative research between natural rubber producers and synthetic rubber manufacturers.

Recent research at the Rubber Research Institute of Malaya on the cross-linking of natural rubber on storage has indicated that natural rubber is not just a simple polymer of isoprene but that it contains 10 to 30 alhedyde groups and some 250 to 300 reactive sites in the cis-polyisoprene molecular chain, which are responsible for its superior overall characteristics.

According to this claim the synthetic cis-1, 4-polyisoprene is not a true synthetic natural rubber in the strict sense of the word. Some of the essential properties of natural rubber, admittedly, have been duplicated but these abnormalities in the natural rubber molecule contribute to the superior characteristics, such as better processing, more tack and better tear properties, which are lacking in the synthetic counterpart.

These reactive groups open the way to the preparation of improved natural rubbers by combination with suitable chemicals.

In conclusion I quote from the address given at the Natural Rubber Research Conference held in Kuala Lumpur, Malaya, in September 1960 by Professor Geoffrey Gee, F.R.S., an authority on rubber chemistry "From a physico-chemical

or technological standpoint the future position of natural rubber must be that of one of a range of elastomers. The scope of its modification must be less than that of synthetic materials and it would be foolish to assume that the full strength of the future synthetic challenge can yet be assessed. Its qualities are, however, so good that the expanding total demand of elastomers seems to me to indicate that available supplies of natural rubber will be fully utilized in the foreseeable future, provided the price remains economic. I believe that the correct policy for the industry is a competitive-collaborative relationship with manufacturers of synthetic polymers and the closest possible liaison with elastomer users.

Fundamental scientific study and technological development of natural rubber and its application both alone and in blends, will enable the industry to look to the future with quiet confidence".

INVESTIGATIONS ON THE EFFECTS OF COPPER DUSTS USED TO CONTROL PHYTOPHTHORA LEAF DISEASE

PART II. REMOVAL OF COPPER FROM SCRAPS

By

K. F. Heinisch, M. Nadarajah and M. T. Veerabangsa

Introduction:

It has been shown that the copper content of crepe and sheet made from latex from copper-dusted areas, although increased, does not exceed the RMA specification. This is because any contamination of the field latex by copper dusts is largely removed in the process of coagulation (1,2). This is, however, not the case with scraps. Part I of this paper has shown the extent of contamination of the scraps with copper and the necessity to bring the copper content within the specification (2).

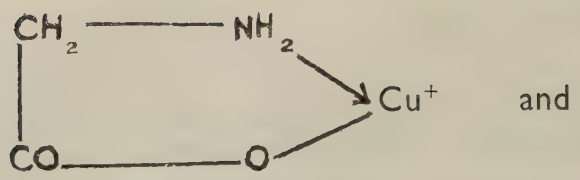
The degree of copper contamination can be considerably reduced by the implementation of preventive precautions in the field and by a blending of scraps from dusted and undusted fields. Not all scraps are highly contaminated and the blending procedure is aimed at obtaining a more homogeneous distribution of the copper over a large quantity of rubber.

A way of removing a superficial copper contamination is by using suitable detergents to reduce the interfacial tension between the rubber and the copper particles so that the contamination is easily washed away. In actual practice, however, this procedure works only to a limited extent, suggesting that the copper is not only on the surface, but that an appreciable part is occluded inside the scraps or is milled into the scraps during the washing procedure in the scrap washer and on the macerator.

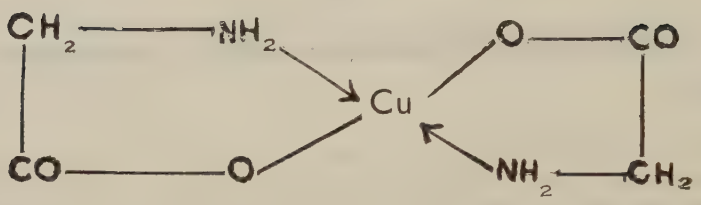
Another procedure believed to be more effective is the use of sequestring agents, compounds which are able to form soluble complexes with the metal ion. Besides the tri–and tetra sodium salt of ethylene diamine tetra acetic acid (EDTA) attention has also been concentrated, on cost grounds, on materials with sequestring properties which are normally available in the rubber factory. These are the amino acids present in rubber serum, and oxalic acid which is sometimes used as a latex coagulant in crepe manufacture.

It is customary on estates to soak scraps overnight in water, or in a solution of sodium bisulphite (8 oz. to 40 gallons of water), or in waste rubber serum, in order to prevent unnecessary oxidation and darkening in colour and to soften the rubber before milling (3). Altmann (4) has drawn attention to the high level of amino acid concentration in rubber serum, and the presence of at least 14 amino acids has been established (4,5).

These amino acids have the α - amino-carboxylic structure and hence they should form copper complexes, a reaction that has been used for their quantitative assay (6). Monk (7) showed that Cu^{++} ions may form 2 complexes CuR^{+} and CuR_2 with glycine, alanine and glycylglycine between pH 4.5 and 6, which include the pH of rubber serum obtained by acid coagulation of latex. The complexes for glycine are:



and



Boorsook and Thimann (12) studied the complex formed between cupric ion and glycinate (G^-) ion and between cupric ion and alaninate (A^-) ion and concluded from spectrophotometric and electrometric data that the complex ions formed in alkaline solutions were CuG_2 and CuA_3 respectively. Crumpler and Dent (8) have established that all the amino acids which have been identified in rubber serum, with the exception of cystine, are able to form complexes with copper.

These copper complexes are reversibly broken down in acid medium, and in strongly alkaline environment the base displaces the amino acid from the complex. Mellor and Maley (9) have pointed out that the stability of complexes of bivalent metal ions follows the order: Pd> Cu> Ni> Co> Zn> Cd> Fe> Mn> Mg irrespective of the nature of the bonds involved. The more stable the complex the lower the pH at which it can persist. On the basis of data of Irving and Williams (10) it can be expected that copper ion will form stable complexes with the amino acids of the rubber serum at a coagulation pH of about 4.5 to 5.

Just as the C^{++} ion forms five-membered rings with amino acids it also forms five-membered rings with the oxalate ion; the bonds with amino acids are more stable than those with oxalate because of the preference of the copper ion for bonding to nitrogen rather than to oxygen (7). According to Britton and Jarrett (13) cupric oxalate is precipitated by oxalic acid from cupric salt solutions. The sparingly soluble oxalates of copper are, however, appreciably soluble in solutions of alkali and ammonium oxalates, the copper being in the anion $Na_2Cu(C_2O_4)_2.2H_2O$. U.S. Patent No. 2,950,183 (1960) claims that by the addition of appropriate amounts of oxalic acid or soluble oxalates, copper is retained in the state of lower valency even at the high pH of 6.1 to 7.0.

EXPERIMENTAL:

Solubility of Copper Dusts:

The commercial copper dusts used in the experiments were: "Blendox", containing 6% copper based on copper oxychloride, and "Ciba C115", with 1% copper based on copper oxychloride and containing a sticker. The solubility of the copper compound in these dusts in different solutions was determined by stirring 1 gr. of the copper dust for 10 minutes in 100 ml of the solution, keeping it for 24 hours, filtering through a sintered glass crucible and determining the copper in the solution. The solubilities at various concentrations in different solutions are expressed in percent of the total copper and are given in Table 1.

TABLE 1

Solubility of Copper from Copper Dusts as % of Original Copper

Concentration of reagents in %	Formic acid	Ammonia	Ammonium phosphate	Sequestrene Na 3	Sequestrene NA 3 + Sodium hydroxide	Sequestrene NA 3 + Oxalic acid	Ammonium oxalate	Oxalic acid	Sodium carbonate + Oxalic acid	Ammonium phosphate + Oxalic acid	Sodium phosphate + Oxalic acid	Sodium bisulphite
					CIBA DUST							
0	7	7	7	7	7	7	7	7	7	7	7	7
0.02	81	14	3	37	40	94	37	88	69	74	76	—
0.05	87	40	3	73	69	97	70	86	91	87	78	—
0.10	92	68	4	88	86	84	78	81	86	86	83	78
0.20	90	83	30	75	100	89	80	68	91	97	87	78
0.50	92	84	22	64	100	90	91	65	100	98	92	75
1.00	95	78	35	83	100	80	91	55	100	99	86	79
					BLENDOX DUST							
0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
0.02	32	2	0	6	6	14	6	21	2	16	13	—
0.05	79	3	0	14	13	38	14	30	3	36	27	—
0.10	99	11	0	41	33	44	38	19	11	37	27	47
0.20	99	29	3	59	57	75	53	8	47	57	36	45
0.50	97	42	3	100	96	90	97	7	59	60	55	63
1.00	96	76	7	100	100	86	99	6	58	69	81	68

The results show that the solubility of the copper oxychloride from the two commercial dusts is quite different and that the copper from "Ciba C115" dissolves more easily and in lower concentrations of the solutions than the copper from "Blendox". Copper oxychlorides may have different compositions, of which probably only $Cu(OH)Cl$ and $Cu_2(OH)_3Cl$ or 3 $Cu(OH)_2CuCl_2.H_2O$ exist as stable compounds. The latter compound has four slightly differing modifications, which may explain the differences in the solubility.

A dilute solution of formic acid appears to be the most suitable solvent for the copper in both of these dusts. Since the concentration of formic acid in waste rubber serum is normally between 0.05% and 0.1%, the amount of copper dissolved from 1 gr. of dust by 100 ml of serum should be about 80-90% of the original copper, because of the additional presence of amino acids. It was found experimentally to be between 70-90% for "Ciba C115" and 80-95% for "Blendox". In waste crepe rubber serum with oxalic acid as the coagulant, the solubility was about 40–70% for "Ciba C115" and 50–80% for "Blendox". Oxalic acid has been found to be less effective at higher concentrations, but the addition of mild alkalies, *e.g.* sodium carbonate and sodium phosphate, improves its effect even at the high concentrations.

In the removal of copper contaminations from panel scraps two different types of copper have to be considered, *viz.* the copper oxychloride from the dust, present only during the relative short dusting period, and the organic bound copper, frequently present in higher concentrations, which is derived in the form of enzymes from the bark. No direct conclusion can, therefore, be made from the solubility figures of the dust alone, as several other factors in the treatment of the scraps may also be involved.

Copper-amino acid complexes:

The presence of several copper complexes of the amino acids in serum obtained by using oxalic acid or formic acid as the latex coagulant was shown by adding 3 gm of the copper dust to 100 ml of the serum, stirring it for 10 minutes, allowing the solution to stand overnight and then separating the copper complexes of the amino acids present in the solution by:

(*a*) paper chromatography, using the descending technique and Butanol-Acetic acid–Water (4: 1: 5) as the solvent, details of which are given by Smith (15).

(*b*) paper electrophoresis, using sodium borate as the buffer (0.025 M sodium borate + 0.05 M sodium hydroxide, pH 10) at 230 volts for 2 hours, according to the procedure described by Szwaj and Kanski (16).

Spraying the paper with ninhydrin (0.1%) and heating it to 100–105°C showed the presence of amino acids, or the amino acid part of the copper-amino acid complexes. By spraying with a 0.1% solution of rubeanic acid the copper part of the copper-amino acid complexes could be identified (Figure 1). Both the paper chromatography and paper electrophoresis experiments showed that several copper complexes of the amino acids were present in the solution and hence it may be concluded that the copper complexes of the amino acids are stable in the alkaline as well as the acid range of pH.

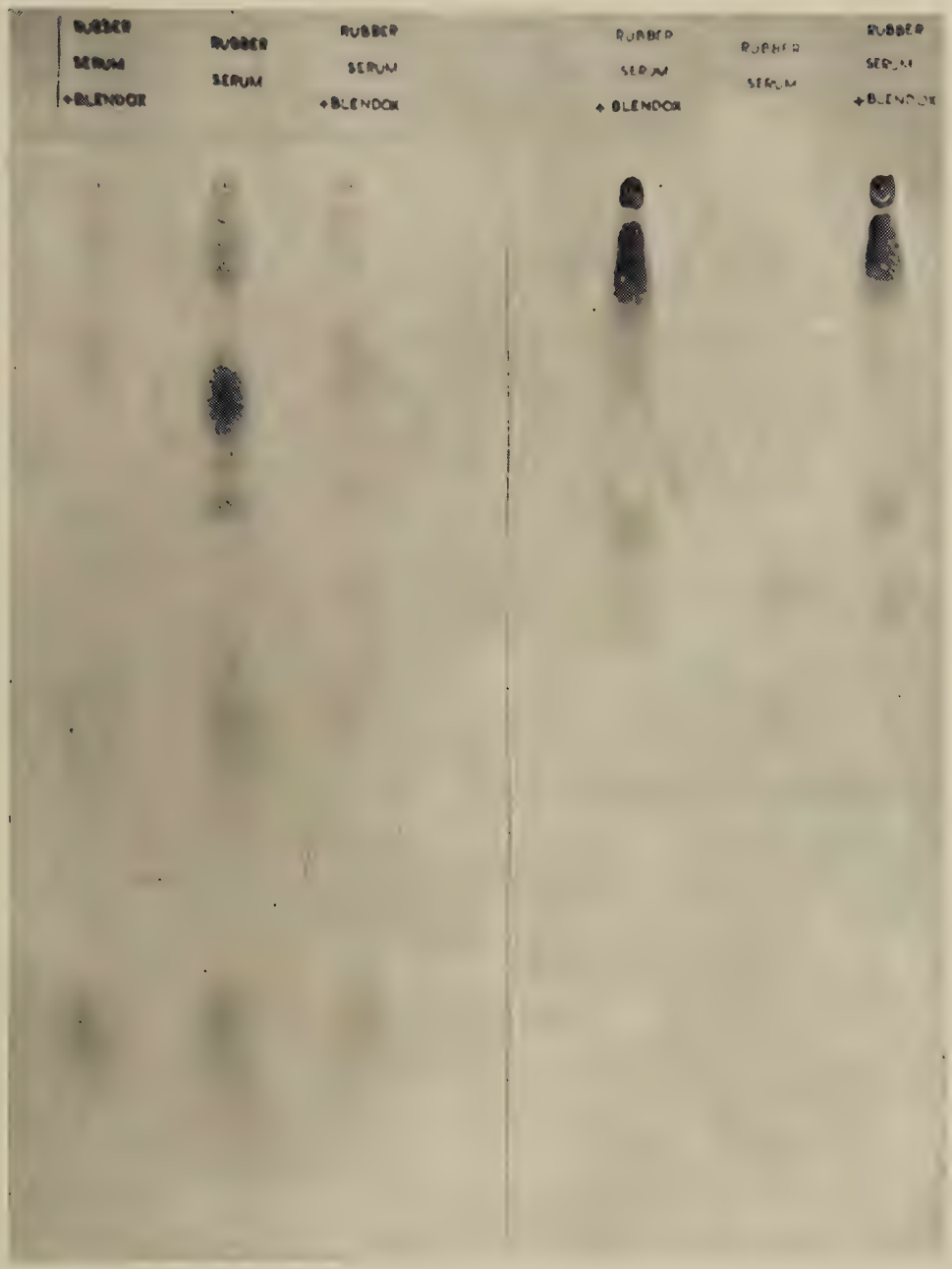


Figure 1. Paper chromatography of rubber serum containing copper from Blendox 6%

Left: Sprayed with Ninhydrin
Right: Sprayed with Rubeanic acid

Removal of copper from artificially contaminated scraps:

Fresh wet scraps were dusted with copper dust to give an approximate copper content of 30 p.p.m. The scraps were allowed to dry and small lots of the contaminated scraps were then soaked for 24 hours in 10 times the weight of different solutions. The samples were thereafter passed through the scrap washer and processed according to normal factory procedure.

The copper remaining in the laces after treatment is shown in Table 2.

TABLE 2

Removal of Artificial Copper Contamination from Panel Scraps
Cu in p.p.m.

Treatment	Concentration of Solutions in %				
	0	0.1	0.2	0.5	1.0
Oxalic Acid ...		7.9	7.5	6.9	6.2
Formic Acid ...		14.8	5.9	3.5	2.0
Oxalic Acid + Sodium carbonate ...		10.9	10.4	11.6	
Sequestrene ...		3.9	5.5	5.8	
Sequestrene + Oxalic acid ...		4.9	5.3	3.9	3.7
Ammonia ...			15.9	12.1	14.2
Ammonium oxalate ...			12.1	17.5	12.7
Formic acid serum ...	5.8				
Oxalic acid serum ...	2.5				
Teepol ...			24.1		
Control before soaking ...	26.0	29.5	29.5	30.8	29.5

Panel scraps are generally contaminated with adhering bark and mineral matter which are only partially removed during the normal procedure of manufacture and blankets made from these scraps have a high dirt content. It has therefore been recommended for removal of these contaminations (17), to soak the scraps in a solution of 0.1-0.2% of "Detergent 40E" and 0.1% Trisodium phosphate. It would appear that this solution is also able to remove copper contaminations resulting from dusting with copper fungicides, as shown by the figures given in Table 3. In order to determine how much copper has been dissolved, the copper content of the soaking solutions has been determined. The difference between the obtained and expected copper contents is the amount which has been mechanically washed off during milling.

TABLE 3

Removal of Artificial Contamination
Cu in p.p.m.

Treatment	pH	Copper in Scrap Crepe Blankets	Copper in Soaking Solution	
			Obtained Cu	Expected Cu
Uncontaminated Scrap ...		11.5		
Water ...	6.6	8.2	6.0	28
Detergent 40E (0.1%) ...	6.6	8.3	9.0	27.9
Detergent 40E (0.1%) +Trisodium phosphate (0.1%) ...	7.3	7.2	5.7	29.0
Sequestrene NA3 (0.05%) ...	7.0	4.8	18.5	31.4
Detergent 40E (0.1%) + Sequestrene NA3 (0.05%) ...	6.8	4.8	18.9	31.4
Detergent 40E (0.1%) + Sequestrene NA3 (0.05%) + Trisodium phosphate (0.1%)	7.6	7.3	19.5	28.9
Control (no soaking) ...		36.2		

In addition some figures for a combined treatment are given in Table 4.

TABLE 4

Combined Treatment for Removal of Copper
Cu in p.p.m.

Treatment	Original Scrap	Scrap contaminated with "Ciba 115"
1 day in 0.2% oxalic acid, followed by 1 day in 0.2% Detergent 40E + 0.1% Na_3PO_4 ...	6.5	9.6
1 day in 0.2% oxalic acid, followed by 1 day in 0.2% Detergent 40E + 0.1% Sequestrene ...	3.3	9.0
1 day in 0.2% oxalic acid + 0.2% Sequestrene, followed by 1 day in 0.2% Detergent 40E + 0.1% Na_3PO_4 ...	4.0	6.6
Control ...	13.2	36.2

From the figures in Tables 2, 3 and 4 it would appear that soaking of scrap rubber contaminated with copper dust, in diluted solutions of oxalic acid, formic acid and sequestring agents, as well as in combinations of sequestring agents with oxalic acid and "Detergent 40E" and in waste rubber serum, may considerably reduce the copper content of the resulting blankets below the specified upper limit of 8 p.p.m.

Also samples with an extremely high original copper content of about 70–110 p.p.m. (which may occasionally occur during commercial copper dusting) showed after treatment with a 0.2% solution of formic acid and oxalic acid respectively a final copper content between 4–5 p.p.m.

Removal of Natural Copper:

It has been already mentioned in Part I of this paper, that the natural copper content of the panel scrap may often be considerably higher than that of the corresponding latex due to the absorption of phenol oxydase, a copper-containing enzyme, from the bark. Accordingly, the blankets manufactured from scrap rubber obtained from undusted areas may have a copper content above the specified maximum value of 8 p.p.m. From Table 5 it may be seen that the chemical treatment also partially extracts the naturally present copper. It appears that the time of soaking may, under certain circumstances, be of importance. A prolonged treatment generally improves the extraction, but in the case of oxalic acid and oxalic acid serum (except in combination with "Detergent 40E") it seems advisable not to extend the soaking for more than one day, as the dissolved and complexed copper precipitates out at a longer soaking period.

It has also been observed that a prolonged soaking in water may reduce the natural copper content, partly by leaching out the water-soluble enzyme, and mainly also to the amino acids formed by decomposition of the proteins, which form a complex with the copper and convert insoluble copper compounds into a soluble form.

TABLE 5

Reduction of the Natural Copper Content of Panel Scrap
Cu in p.p.m.

Treatment	Days of Soaking	
	One day	Two days
Water ...	8.3	3.6
Detergent 40E (0.1%) ...	6.8	6.7
Detergent 40E (0.1%) + Trisodium phosphate (0.1%) ...	2.0	3.7
Oxalic acid (0.2%) ...	3.4	9.8
Oxalic acid (0.2%) + Detergent 40E (0.1%)	2.6	8.5
Oxalic acid serum ...	2.5	10.6
Oxalic acid serum + Detergent 40E (0.1%) ...	3.3	2.3
Formic acid serum ...	9.6	5.2
Formic acid serum + Detergent 40E (0.1%) ...	4.3	3.8

Original copper content of the scraps: 12.0 p.p.m.

To determine the amount of water-extractable copper, fresh panel scraps, collected two hours after cessation of dripping from 9-year-old rainguarded trees of clone PB 86, have been extracted for 24 hours and 72 hours respectively with water at a temperature of about 5°C in a refrigerator. The water extract gave in all cases with catechol a positive reaction for phenol oxidases. Figures are reproduced in Table 6.

TABLE 6

Extraction of Fresh Panel Scraps
Cu and Mn in p.p.m.

Treatment	24 hours Soaking		72 hours Soaking	
	Water extract	Rubber	Water extract	Rubber
Copper p.p.m. ...	5.6	7.2	5.5	10.4
Manganese p.p.m. ...	6.9	22.8	8.6	15.4

As it has been observed that the natural manganese and iron content of scrap rubber is also very high, due to the absorption of probably arginine-amidases, iron–porphyrine enzymes (catalase, peroxydase) and cytochromes from the bark, some tentative analysis figures for manganese (Table 6) and manganese and iron (Table 7) have been included.

From Table 7, which shows some results of a combined treatment for removal of copper and mechanical dirt, it may be seen that the treatment, initially intended mainly for the reduction of the natural copper and dirt content, also results in a considerable reduction of the naturally present manganese content, although not below the specified maximum of 10 p.p.m. About $\frac{3}{4}$ of the iron is extracted but the final iron content remains high. However, there is no specification limit for the iron content of rubber.

TABLE 7

Combined Treatment of Panel Scraps

Treatment	p.p.m. Copper		p.p.m. Manganese		p.p.m. Iron		% Dirt	
	24 hrs.	48 hrs.	24 hrs.	48 hrs.	24 hrs.	48 hrs.	24 hrs.	48 hrs.
Formic acid serum ... followed by 0.2% Detergent 40E + 0.1% $Na_3 PO_4$ ...	4.2	3.1	17.0	13.1	480	330	0.27	0.28
	4.1	3.2	17.6	13.1	503	362	0.28	0.17
Formic acid serum + 0.1% Sequestrene ... followed by 0.2% Detergent 40E + 0.1% $Na_3 PO_4$ ...	4.4	3.7	17.4	12.5	510	322	0.30	0.28
	4.0	2.8	15.9	11.5	584	345	0.19	0.15
Water ...	7.3	6.6	24.4	22.9	566	588	0.31	0.26
Original Scraps ... (untreated)	12.5		31.6		1328		2.2	

A treatment of the panel scraps with a hot 5% solution of the tetra sodium salt of EDTA (Sequestrene) seems to be very effective in reducing the manganese content below 10 p.p.m. This extraction is dependent on the pH of the solution and is, for manganese, more effective at a high pH (about 10), whereas for copper a lower pH (about 5–6) seems to be required. The results of these experiments will be given in a later report.

Factory Practice:

As it appears that panel scrap may have a considerably high natural copper content, it is recommended to apply a treatment for the reduction of this copper content as a normal procedure throughout the year, and not only during the relatively short period of dusting against *Phytophthora* when mechanical contamination with copper dust may be expected. The natural copper content should be considered as important as the risk of outside copper contamination.

It is recommended, therefore, to soak all panel scraps and earth scraps, and preferably also the cup scraps, for two days in five to ten times the volume of fresh serum to which 0.1% "Detergent 40E" may be added. In case of oxalic acid serum alone the soaking period should, however, be only 1 day unless Detergent 40E is added.

Another procedure ensuring a better removal of mechanical dirt, which can only be applied if sufficient tank space for soaking is available, would be to soak the scraps for two days in serum, followed by a two days' soaking in a solution of 0.2% Detergent 40E and 0.1% Trisodium phosphate.

Care should be taken to ensure that the scraps are properly submerged in the soaking solution.

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HISTORY AND DESCRIPTION OF PROMISING RRIC CLONES

By

C. A. de Silva and R. Satchuthananthavale

Introduction:

The scope of the present series of articles is to provide a description of the vegetative characters of a few promising RRIC clones, which are recommended for planting on a limited scale on commercial estates.

Descriptive diagrams are given to illustrate the vegetative characters used in the description of the clones.

These would enable planters to reassure themselves of the authenticity of the material obtained from commercial nurseries, especially as a number of selected RRIC clones have recently been declared "free" clones in this country.

Budwood of these clones will be multiplied in registered nurseries in order to meet the demand for planting material of these selected new clones.

A brief description of each clone with the available growth and yield data will be given in this series of articles.

Description of clones:

The word 'clone' is derived from the Greek work 'klon' meaning a twig. It signifies a group of plants produced vegetatively from a selected seedling mother tree. Since all the individuals of a single clone originate from one parent tree, they are genetically alike. They are also remarkably alike in appearance when grown in a uniform environment.

The morphological characters could, however, differ somewhat according to the environment in which the clone grows. Nevertheless it is possible to identify one clone from another with a knowledge of certain characters which are reliably consistent within a single clone. Persons who are in constant touch with budwood nurseries eventually become experts in identifying a clone.

In some cases it is possible to identify a clone, with a knowledge of one or two particular characters which differentiate it conspicuously from other clones. Such characters will be accentuated in these descriptions, where possible, for ease of identification.

In general, however, the identification of young budgrafts of particular clones must be based on a combination of characters and these are given in the descriptions of these clones.

The most favourable period for identification is when the buddings are 12 to 18 months of age.

Identification of the mature budded trees is more difficult and is not always reliable. The mature seeds of trees of any one clone are, however, consistently uniform in the external characters of the seed coat which is derived from the tissues of the mother tree and is independent of the male parent.

All seeds borne by trees of the same clone are very similar in shape and markings and trees of a particular clone can therefore be identified as true to type by comparing their seed with authenticated seeds of the same clone.

A classification of the vegetative characters used in the identification of clones of *Hevea brasiliensis* is given below:—

Stem:

The stem characters considered for description are expressions of inherent growth habits but these are subjected to environmental influences, especially the direction of the incidence of sunlight (heliotropism). Such characters are not very reliable for identifying clones. The characters can be described as (*a*) Stout or Slender; (*b*) Straight or Crooked; (*c*) Upright or Leaning.

Leaf Storey:

The leaf storeys provide several of the most valuable diagnostic characters. These are best shown by the youngest fully grown flush, which is usually the storey immediately below the uppermost one.

(*a*) *Shape of Leaf Storeys.*

This is best observed from a distance and may be:– Conical (Fig. 1); Truncate (Fig. 2); Hemispherical (Fig. 3) or Segment of a hemisphere (Fig. 4).

Figure 1. Leaf storey: Conical.

Figure 2. Leaf storey: Truncate cone; Open.

Figure 3. Leaf storey: Hemispherical.

Figure 4. Leaf storey: Segment of a hemisphere; Closed.

(*b*) *Separation of the Leaf Storeys.*

They may be:— Well separated (Fig. 5); Distinctly separated (Fig. 6); Not well separated, as when they merge somewhat into one another (Fig. 7).

Figure 5. Separation of Leaf storeys: Well separated.

Figure 6. Separation of Leaf storeys: Distinctly separated.

Figure 7. Separation of Leaf storeys: Not well separated.

(*c*) *Other characters.*

The other characters used in the description of the leaf storeys are: Open or Closed, Dense or Sparse foliage. A storey is described as open when the leaf stalks are well separated and one can see through it (Fig. 2). A closed storey in which the leaf stalks are close together, presents an opaque or nearly opaque surface which one cannot see through (Fig. 4). The latter is sometimes the result of declining petioles or drooping leaflets or both.

Leaf Stalks:

The arrangement of the leaf stalks in relation to the main axis, and their shape, are useful identification characters.

(*a*) *The arrangement of the leaf stalks in relation to the stem may be:*—Horizontal (Figs. 8, 9, 12); Inclined (Fig. 10) or Declined (Fig. 11).

(*b*) *The shape of the leaf stalks may be:*—Arched (Fig. 8); Straight (Fig. 9); Concave (Fig. 12) or 'S' shaped (Fig. 13).

Figure 8. Leaf stalks Arched and Horizontal.

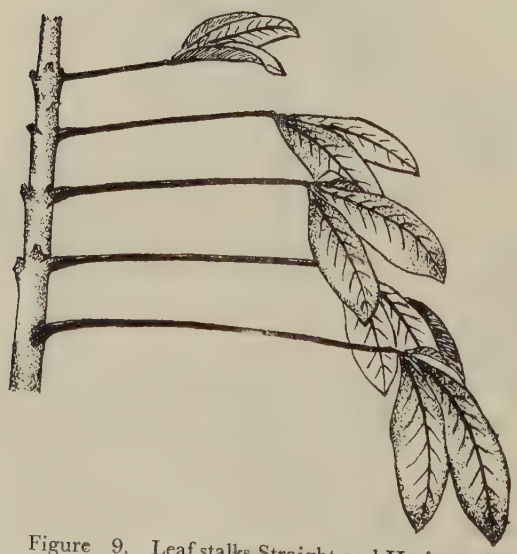

Figure 9. Leaf stalks Straight and Horizontal.

Figure 10. Leaf stalks Inclined.

Figure 11. Leaf stalks Declined.

Figure 12. Leaf stalks Concave.

Figure 13. Leaf stalks 'S'-shaped.

Leaflets:

The more important characters of the leaflets are:— Degree of Separation of the leaflets, Shape, Margin, Lustre and Colour, Pitch and Appearance in transverse and longitudinal sections (usually the middle leaflet is used for purposes of identification).

(*a*) *Degree of Separation of leaflets.*

Leaflets may be:—Overlapping (Fig. 14); Touching (Fig. 15) or Separated (Fig. 16).

(*b*) *Shape.*

The shape is usually either Elliptical (Fig. 14) or Pear-shaped (Fig. 16).

(*c*) *Lustre and Colour.*

This character is so much influenced by the environment that it cannot be relied upon. Leaves of certain clones show a characteristic shine or colour.

(*d*) *Leaf Margin.*

The leaflet margin may be either Smooth or Wavy.

(*e*) *Pitch.*

Pitch is the inclination of the leaflet to the horizontal. This may be Inclined (Fig. 17); Flat horizontal (Fig. 18) or Declined (Fig. 19).

(*f*) *Transverse Section of leaflet.*

When the leaflet is cut across the middle, the cross section may be 'V'-shaped, Concave, Flat or Convex.

(*g*) *Longitudinal Section of leaflet.*

The leaflet may appear Straight or Arched.

Extra-Floral Nectaries:

Another character of some value in identification is the nature of the extra-floral nectaries. These may be well developed in some clones, *e.g.* RRIC 52 (Fig. 14); in others they may be hardly visible.

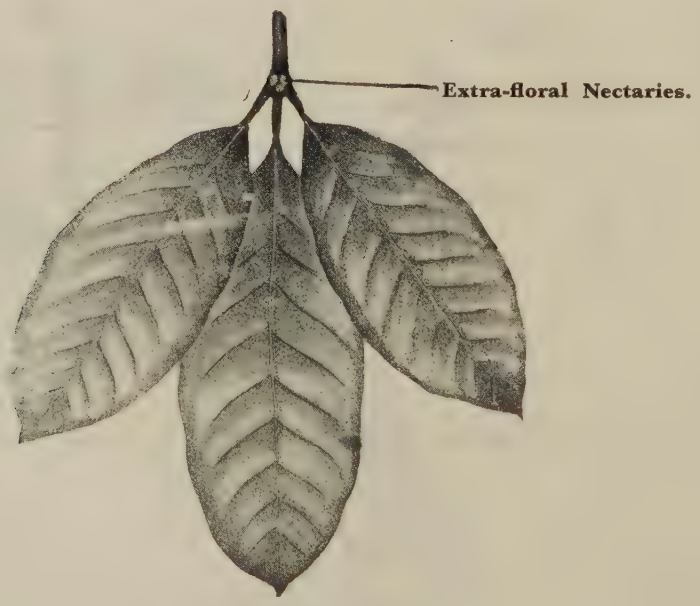

Figure 14. Leaflets Overlapping.

Figure 15. Leaflets Touching.

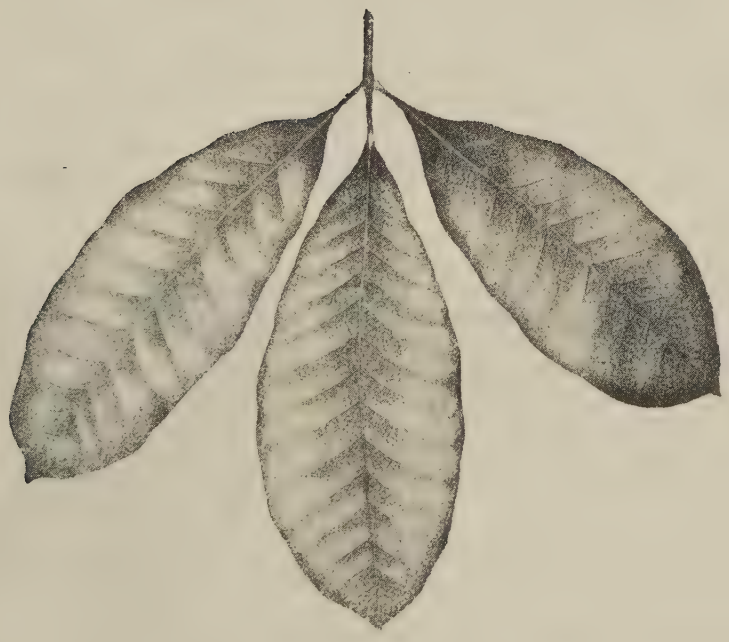

Figure 16. Leaflets Separated.

Figure 17. Leaflets Inclined.

Figure 18. Leaflets Horizontal.

Figure 19. Leaflets Declined.

CLONE RRIC 52

General Description.—Clone RRIC 52 was established in 1944 from a Tjikadoe seedling planted in 1935 at the Nivitigalakele Station (Figure 3). The five original budgrafts were the most vigorous grown trees in the 1944 clone trial at Hedigalla Station. The clone partially wintered for the first time in the 11th year of life and has partially wintered in subsequent years. It has a broad-angle branching habit with a spreading balanced crown. It is tolerant to shade and preserves a dense dark green foliage on the shaded lower branches (Figures 4 and 6).

Clone RRIC 52 is appreciably tolerant to diseases caused by *Oidium* and *Phytopthora*, especially Bark-Rot of the tapping panel (Figure 5).

Clone RRIC 52 was planted in a second clone trial in 1949, with 150 trees each of 31 clones, at Hedigalla Station. The girth and yield figures are given in Tables 1 and 2 and are also represented in Graphs 1 and 2.

Clone RRIC 52 is late maturing, starting with only moderately high yields and then yielding approximately up to the standard of clones PB 86 and RRIM 501 by the 4th year of tapping. The characteristic trend of yields of clone RRIC 52 is indicated in Graph 2.

Clone RRIC 52 should preferably be planted at a spacing of $15' \times 18'$, with a stand of 160 trees per acre, to enable the clone to fully develop its potentialities for vigorous growth.

Identification of clone RRIC 52.—The vegetative characters of a young nursery budding are described below for purposes of identification (Figures 1 and 2).

Stem:—Straight and erect.

Leaf Storey:—Fairly large hemisphere; well separated; somewhat open, moderately dense foliage.

Leaf Stalk:—Horizontal and straight to slightly inclining in the younger storeys.

Leaflets:—Slightly overlapping; elliptical; margin slightly wavy; colour dark green to dull green; pitch flat horizontal to slightly declining; transverse section of leaf straight to slightly concave; longitudinal section nearly straight.

Other characters:—Extra-floral nectaries very prominent (Figure 2).

Seed

General shape and colour:—Roundish and regular shaped, fairly large, slightly shiny and greyish brown.

Curved surface:—A slight central ridge with sparsely distributed irregular dark brown markings on a uniform greyish brown background.

Ridge side:—A well marked frontal depression with two uniform cheeks well separated from the central ridge.

The seed of clone RRIC 52 shown in Figure 7 is about half the natural size.

TABLE 1

Clone Trial—Wide Avenue Planting—1949 Clearing, Hedigalla
Planted 6′ × 45′

Average Girth Measurements in Inches

	Height from Union	RRIC 52	PB 86	RRIM 501	Mean
December 1951	3 feet	6.5	6.1	5.3	6.0
,, 1952	3 ,,	11.0	9.8	9.0	9.9
,, 1953	3 ,,	15.2	12.8	12.3	13.4
,, 1954	3 ,,	20.2	17.1	16.1	17.8
,, 1955	3 ,,	21.8	18.4	16.9	19.0
,, 1956	3 ,,	25.5	*	*	—
,, 1957	4 ,,	27.5	22.9	20.1	23.5
,, 1958	4 ,,	29.7	24.9	21.6	25.4
,, 1959	4 ,,	31.6	26.5	22.6	26.9
,, 1960	4 ,,	33.8	28.2	24.1	28.7

*Girth figures for 1956 available for Clone RRIC 52 only.

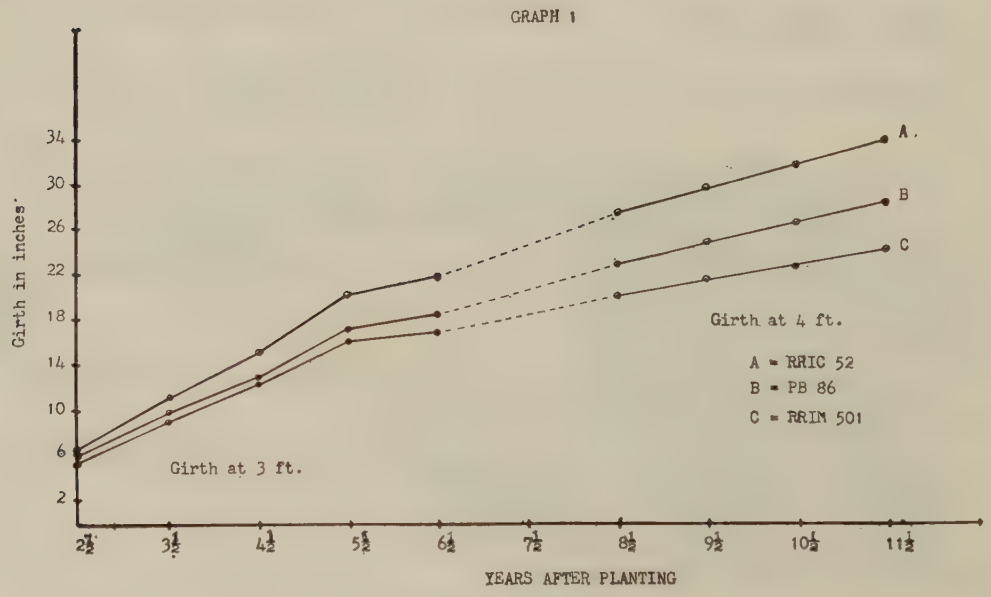

TABLE 2

Yield in pounds per tree per year

Year of tapping	Tapping intensity	Yield		
		RRIC 52	PB 86	RRIM 501
1957	S/2, d/3, 67%	3.3	5.5	4.8
1958	,,	5.1	7.6	6.9
1959	S/2, d/2, 100%	9.2	12.1	9.6
1960	,,	14.4	15.0	14.7

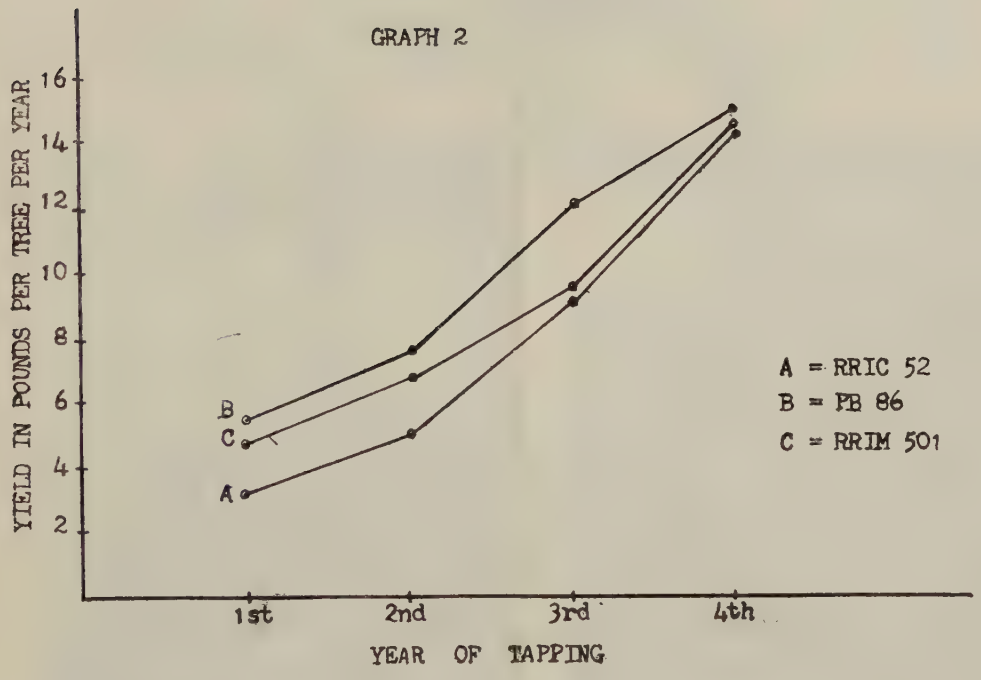

Figure 1

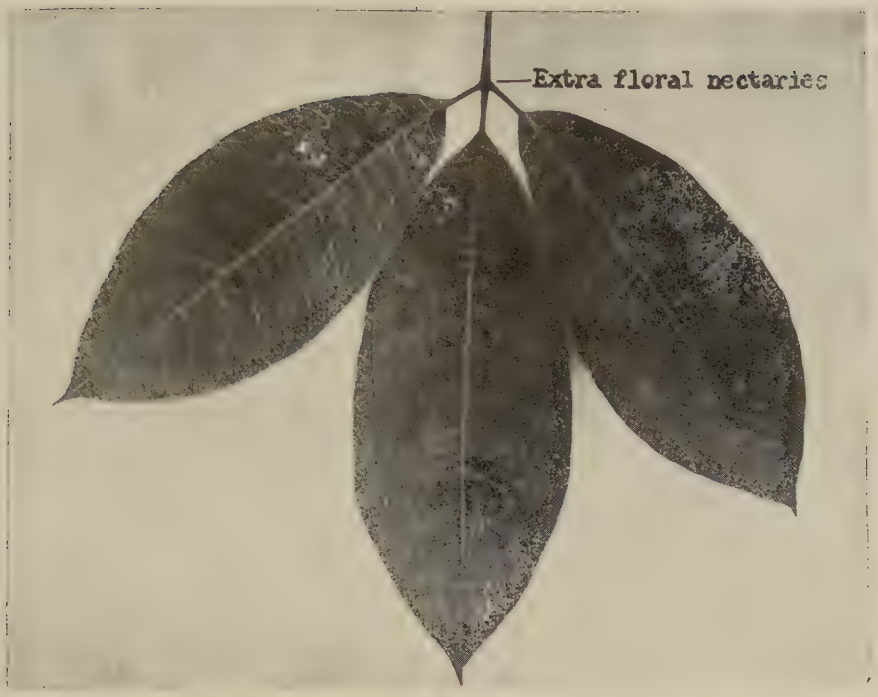

Figure 2

Figure 3

Tjikadoe Seedling tree No.108 from which Clone RRIC 52 was established in 1944.

Figure 4

The dense foliage and vigorous growth of Clone RRIC 52 in the 1944 clearing, Hedigalla Station.

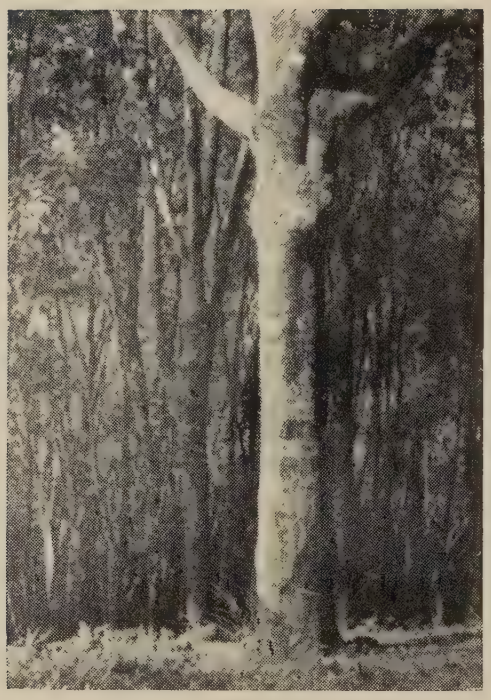

Figure 5

The tapping panel of Clone RRIC 52 in the 1944 clearing, Hedigalla Station.

Figure 6

Vigorous growth of Clone RRIC 52 compared with other clones in the 1944 clearing, Hedigalla Station.

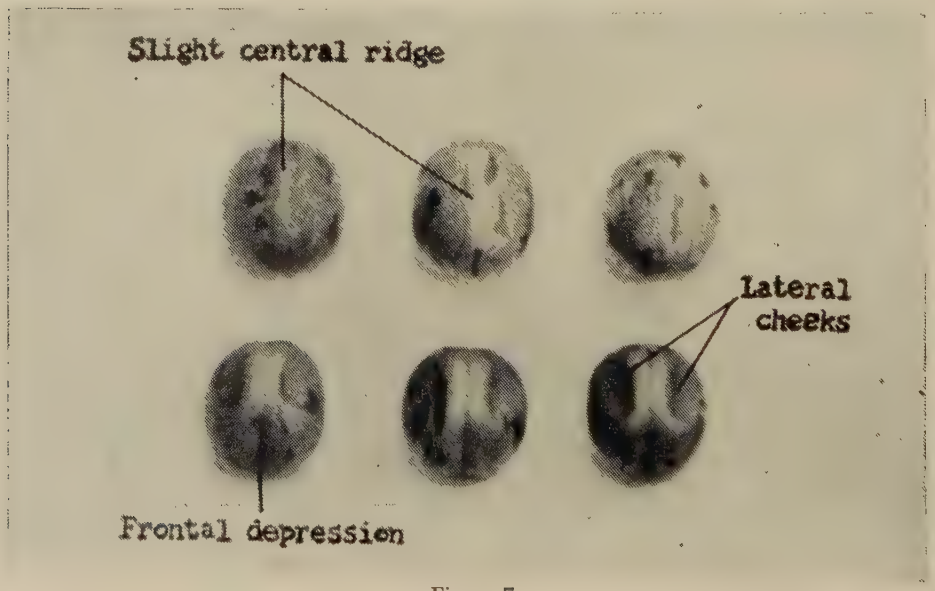

Figure 7

Seeds of Clone RRIC 52 (approximately × 1/2), showing curved side — upper row, and ridge side — lower row.

PLANTING TOPICS

Brown Bast Disease of Hevea

Brown Bast is believed to be a physiological disease of the laticiferous system caused by excessive extraction of latex. It is characterized by discoloration and dryness of an area of bark below the tapping cut.

No fungus or virus is known to be associated with this disease but contamination of diseased areas of bark with gram-negative capsulated bacteria has recently been observed in Malaya.

The work of Rands in Indonesia and of Rhodes in Malaya provides an acceptable explanation of the typical symptoms of Brown Bast disease.

The symptoms of dryness of the tapping cut and discoloration of the underlying tissues are associated with the deposit in the latex vessels and surrounding tissue of "wound gum" which is a secretion of a yellow viscous substance from living cells surrounding the latex-bearing tissues. The secretion of this gum around injured tissues in temperate and tropical trees shows it to be a natural reaction of the plant in the form of a wound response. "Wound gum" deposit is governed by enzyme activity, the greater the enzyme activity the greater the secretion of wound gum and, according to Rhodes, the greater the predisposition to Brown Bast disease in *Hevea*.

A vigorous high-yielding tree is in a state of greater enzyme activity than an unthrifty tree with a poorer yielding capacity. There is, therefore, less tendency for the symptoms of the disease to appear in low-yielding trees.

Under improved methods of cultivation and the use of high-yielding clones and clonal seedlings, the correct intensity of tapping at a particular period in the tapping history of the trees is an important factor in the prevention and control of Brown Bast disease.

Healthy tapping cuts do indeed show a slight deposition of the characteristic "wound gum" in the superficial layers referred to earlier. With the tendency for over extraction of latex in the early years of tapping, the more susceptible trees of high yielding clones and clonal seedlings stimulate the spread of the superficial "wound gum" deposit to the underlying cells surrounding the devitalized laticiferous tissues, thus causing the spread of the disease below the tapping cut.

In more recent years a high stand of about 140 to 150 trees per acre is retained after selective thinning out on growth and yield criteria in the first 3 years of tapping. During these early years of tapping at a relative intensity of 100% the more susceptible clonal planting material can be expected to show an incidence of about 10% of Brown Bast cases. It is for this reason that this Institute recommends tapping such material at a lower relative intensity of 67% on the half-spiral third-daily (S/2, d/3) tapping system in the first 3 years of tapping. There is the feasibility of eliminating the susceptible trees when finally reducing the stand per acre to about 130 trees by the end of the third year of tapping.

If under a particular tapping system a planting shows an incidence of more than 10% of Brown Bast cases, a reduction in the tapping intensity is indicated.

A complete cure of advanced cases of Brown Bast is not possible without the old curative treatment of extensively scraping off all affected tissue down to the cambium and the aftercare of the subsequent healing of these areas. Such a procedure at the present time is clearly uneconomic.

The successful treatment of Brown Bast in its earliest stages may be obtained by making careful observations in the field. Small dry patches noticed on the tapping cut before latex begins to flow down the cut indicate the earliest visible symptoms of the disease. Resting the affected trees for three to six months can bring back many of these trees to a healthy condition for tapping after the resting period.

If the early symptoms are overlooked and control measures are not adopted the condition spreads rapidly to the underlying tissues. Serious disorganization is brought about by special meristems, similar to the cambium, which produce actively growing tissue among healthy cells of the cortex. Strips of wood and bark forming the characteristic nodules and latex exudation are the advanced stages of the disease.

Long before these advanced stages are reached it would be economical to extract the maximum quantity of latex from the trees by opening high cuts above the normal tapping panel and tapping upwards. The trees are then uprooted.

This short description of the incidence and spread of Brown Bast disease clearly indicates that "Prevention is better than Cure", and every effort should be made, under the present conditions of improved cultivation and of vigorous growth of new high-yielding clonal planting material, to obtain high yields in the early years of tapping without unduly straining the trees. In this way the trees can be trained to get into their full stride for high yields without a serious reduction of the permanent stand per acre from Brown Bast, in the early years of the history of a rubber planting.

C. A. de S.

QUESTION CORNER

Question:

Can you please identify the disease on the sample of fresh leaves I have sent you and advise me on the control measures necessary to check the disease?

Answer:

The symptoms seen on the leaves are caused by *Gloeosporium alborubrum*, the causal organism of *Gloeosporium* Leaf Disease. This disease can be easily identified by the presence of tiny pale-pink cheesy masses of spores on the spots or lesions caused by the fungus.

Gloeosporium leaf disease is common on young plants between 1–3 years of age. Severe infection occurs on tender foliage and on young shoots. On young leaves and shoots, spots or lesions are the typical symptoms while on tender leaves shrivelling and distortion are observed. In addition this fungus causes die-back of young bud-shoots of budded stumps and is capable of killing them right back to the bud patch.

Typical spots are circular, 1–2 mm. in diameter, brown in colour with a yellow halo around each spot. Several such spots coalesce to form irregular lesions.

Under damp conditions the fungus spores profusely. Any infected tissue when kept overnight in a damp place will show the characteristic pale pink spore masses, the presence of which confirms the disease.

Usually *Gloeosporium* leaf disease is prevalent during the wet season when conditions are conducive for the multiplication of the fungus and spread of the disease.

Gloeosporium leaf disease can be controlled by spraying the plants in the infected area with a wettable copper preparation at regular intervals of 5-7 days till the end of the wet season. A suitable spray mixture is prepared by dispersing 6-8 oz. of the wettable copper fungicide (containing 50% Copper) in 10 gallons of water.

Spraying should be done either early in the morning or late in the afternoon to avoid scorching of the leaves.

Wherever die-back occurs the affected shoot should be cut back to the healthy tissue and the plant sprayed to check the spread of the disease.

A knapsack sprayer with an extensible lance can conveniently be used to spray the young plants in the field and in the nurseries.

V. S.

Question:

On page 158 of the Planters' Bulletin of the R.R.I.M. No. 56, September, 1961 appears a statement by Dr. G. A. Watson to the effect that "the uptake of fertilizers is more effective if they are applied just before refoliation."

This is indeed an interesting statement since the more common practice in Ceylon is to apply fertilizer in March, just after refoliation.

In view of Dr. Watson's remarks, would you consider that more use would be made of fertilizer application in Ceylon if it were applied to the trees just prior to refoliation?

Answer:

Reference your letter dated 10th November on the above subject, we wish to make the following comments:

1. On theoretical grounds we are in agreement with Dr. Watson's statement. Investigations carried out by Dr. Baptiste when he was in Malaya had revealed an enhanced root activity at the time of refoliation.

2. In practice we have to bear in mind that wintering and refoliation take place during the dry period. During a dry period the moisture regime in the soil may be such that applied fertilizers may not be readily available to the plants until such time as the moisture status in the soil becomes more favourable.

3. Under Ceylon conditions we have another important factor to contend with. Application of nitrogenous fertilizers and its subsequent uptake at the time of refoliation may make the foliage more susceptible to *Oidium* infection. This, of course, could be overcome by applying the phosphatic and potash fertilizers at the time of refoliation and applying the nitrogenous fertilizer after the leaves have passed the susceptible stage. But we would not like to recommend this practice until we have had an opportunity to try it out.

A. J. J.

RUBBER RESEARCH BOARD

174th Meeting

Minutes of the 174th meeting of the Rubber Research Board held at the Headquarters of the Planters' Association of Ceylon 73/1, Kollupitiya Road, Colombo, at 2.30 p.m. on Tuesday 23rd May, 1961.

Present.—T. C. A. de Soysa (in the Chair), Mr. N. Abeygoonewardene, Mr. W. P. H. Dias, J.P., Senator L. Jayasundara, Mr. W. B. Jonklaas, Mr. A. V. Richards (Director of Agriculture), Mr. P. A. Silva (Acting Rubber Controller), Mr. C. R. Warren, Mr. D. P. R. Weerasekera, M.P., Dr. E. D. C. Baptiste (Director) and Mr. C. D. de Fonseka (Chief Administrative Officer).

Board.—The Chairman reported that Mr. P. A. Silva, C.C.S., Assistant Secretary to the Ministry of Agriculture, Land, Irrigation & Power, had been appointed to represent the Rubber Controller from 13th May, 1961 for a period of about 3 weeks, during which period Mr. B. Mahadeva would be away from the Island.

1. Minutes:

(*a*) *Confirmation.*—Draft minutes of the meeting held on 27th March 1961, which had been circulated to members, were confirmed and signed by the Chairman subject to a minor amendment.

(*b*) *Matters arising from minutes:*

1. Soil Survey.—Consideration of the proposal to carry out a soil survey of the rubber growing areas with the co-operation of the Canadian Team was postponed until the receipt of the recommendations of Dr. F. R. Moorman, Soil Classification expert of the F.A.O., who had already inspected the soils in some of the rubber growing areas in the company of the Institute's Soils Chemist.

2. Botanist.—Agreed that Mr. C. A. de Silva, Botanist, should return to the service of the Institute one month after the termination of his present contract, *i.e.* from 1st August, 1961, for a period of 2 years.

2. Administrative Committee.—The recommendations made at the meeting held on 18th April, 1961 were considered and the Board's decisions included the following:

(*a*) *Extra work done on New Soils Laboratory.*—Agreed that the balance due in respect of the additional work done in the new Soils Laboratory be paid to the Contractor and a supplementary vote was passed for this purpose.

(*b*) *Subsistence rates for official visits in U.K.*—Agreed that the rates of subsistence allowance payable to officers for official visits in U.K. be the same as those payable to U.K. Civil Servants.

(*c*) *Appointment of Visiting Engineers.*—Agreed that Messrs. Colombo Commercial Co., Ltd., be appointed Visiting Engineers.

(*d*) *Purchase of a Fogging Machine.*—The purchase of a Swingfog machine for the control of Phytophthora was approved and a supplementary vote was passed for this purpose.

(*e*) *Director's visit to U.K.*—It was reported that the Director would be away from 3rd June to 15th June, attending the meetings of the I.R.R.D.B. in U.K.

3. Staff:

(*a*) *Assistant Librarian.*—Agreed that an acting allowance be paid to Mr. W. Ranasinghe, Clerk Typist, for acting as Assistant Librarian, with effect from 1st May until a new Assistant Librarian is appointed.

(*b*) *Assistant & Minor Staff Changes.*—Changes in staff since the last meeting were reported and approved.

(*c*) *Loans to officers for purchase of transport.*—Three loans given to officers for purchase of transport were reported and approved.

(*d*) *Post of Translator-cum-Typist.*—Agreed that the post be re-advertised in the Sinhala and English newspapers.

4. General Matters:

(*a*) *Exchange of Clones.*—The proposed exchange of clones with the Firestone Plantations Co., Harbel, Liberia, was approved.

(*b*) *Amendments to Rubber Research Ordinance.*—The proposed amendments to the Rubber Research Ordinance, which are now before Parliament, were approved.

(*c*) *Purchase of a motor vehicle.*—The Director was asked to make arrangements for the purchase of a Land Rover with a trailer. A supplementary vote was passed to cover the additional cost as the vote available for this purpose was not sufficient.

(*d*) *Letter from R.R.I.C.E. Union dated* 2-3-61.—The following decisions were arrived at, in regard to the requests made by the R.R.I.C.E. Union in their letter of 2-3-61.

i. A selected delegation of the Union be given the opportunity to represent matters affecting salaries and terms of service of present Assistant and Minor Staff to the Salaries Revision Committee.

ii. Post of Personal Assistant to the Director—Applications from the present staff should be dealt with first and if no suitable applicant was available the post should then be advertised. This procedure should apply to the filling of all vacancies in Assistant and Minor Staff grades.

iii. Posts of Clerk Typist Grade II—It was noted that these posts had already been filled and it was agreed that similar posts in future be filled by Grade III clerical officers who have 5 years' experience.

(*e*) *Tenders for machinery.*—Agreed that the articles rejected by the Board of Survey be sold by public auction.

5. International Rubber Research & Development Board.—Four Reports from I.R.R.D.B. were tabled.

6. Publications.—The following publication was tabled:

1st Quarterly Journal March, 1961.

7. Next meeting.—Agreed that the next meeting of the Board be held at 2.30 p.m. on 29th May, 1961.

8. Any other business:

(*a*) *Publications.*—Agreed that the names of Board members be printed on the inside cover of future Quarterly Journals.

(*b*) *Rubber Conference.*—Agreed that arrangements be made to hold a Rubber Conference in the latter part of 1962.

(*c*) *Interest-free Loan.*—Reported that the second instalment of the interest-free loan of 1 million rupees for the establishment of a sub-station had been received, subject to a cut of 25%.

(*d*) *Plant Pathologist's paper on "Control of the White Root disease of the Para-Rubber tree".*—In response to a request made by the Plant Pathologist he was given permission to publish a paper entitled "On the Control of the White Root disease of the Para-Rubber tree, Hevea brasiliensis, Muell. Arg." in a foreign scientific journal, probably the "Phytopathologische Zeitung".

The meeting then terminated.

175th Meeting

Minutes of the 175th meeting of the Rubber Research Board held at the Headquarters of the Planters' Association of Ceylon, 73/1, Kollupitiya Road, Colombo, at 2.30 p.m. on Tuesday, 4th July, 1961.

Present.—Mr. T. C. A. de Soysa (in the Chair), Mr. W. P. H. Dias, J.P., Senator L. Jayasundara, Mr. W. B. Jonklaas, Mr. B. Mahadeva (Rubber Controller), Mr. A. V. Richards (Director of Agriculture), Mr. C. R. Warren, Mr. D. P. R. Weerasekera, M.P., Dr. E. D. C. Baptiste (Director) and Mr. C. D. de Fonseka (Chief Administrative Officer).

1. Minutes:

(*A*) *Confirmation.*—Draft minutes of the meeting held on 23rd May 1961, which had been circulated to members, were signed by the Chairman.

(*B*) *Matters arising from minutes:*

(*a*) Report of Committee.—The recommendations made by the Committee of Inquiry appointed to investigate into the allegations made by the Assistant Administrative Officer were approved and a vote of confidence in the Director and Heads of Departments was passed.

(*b*) LETTER FROM PLANT PATHOLOGIST.—Noted that Dr. A. Riggenbach, Plant Pathologist, would not renew his contract for a further term of service and that he would leave Ceylon on 4th August. Agreed that Miss V. Sivapalan, Research Assistant, should look after the work of the Department until the return to Ceylon of Mr. O. S. Peries, Assistant Plant Pathologist.

2. Administrative Committee.—The recommendations made at the meeting held on 20th June, 1961 were approved; the Board's decisions included the following:

(*a*) *Chemist Resumption of Duties.*—Reported that Dr. K. F. Heinisch, Rubber Chemist, had returned from overseas leave and had resumed duties on 18-5-1961.

(*b*) *Plant Breeder—M.Sc. thesis.*—Permission was granted to Mr. R. T. Wijewantha to publish the data of his M.Sc. thesis in an International Mycological Journal.

(*c*) *Labourers' Cottages at Kuruwita Sub-station.*—Agreed that the six double cottages to be built at Kuruwita Sub-station be provided with cement floors and a supplementary vote was passed for the purpose.

(*d*) *Multipurpose shop at Dartonfield.*—Permission was granted to the Agalawatta Co-operative Union to run a multipurpose shop at Dartonfield and it was agreed that a suitable building be constructed for this purpose in 1962.

(*e*) *Crepe Rubber Drying Tower.*—An extension of time was granted for the construction of the Crepe Rubber Drying Tower.

(*f*) *Contract for Power Supply.*—A supplementary vote was passed to cover the additional cost of variations in two items of the contract.

(*g*) *Purchase of a Vehicle.*—The purchase of an 88" Wheelbase Land Rover with Trailer was authorized.

(*h*) *Post of Building Foreman.*—Mr. T. S. Basnayake was appointed Building Foreman with effect from 1st August, 1961.

3. Estate and Experimental Committee.—The recommendations made at the meeting held on 30-6-61 were approved; the Board's decisions included the following:

(*a*) *Estate Superintendent's Reports on Dartonfield Group—January to May* 1961—were approved.

(*b*) *Dartonfield Group Accounts—November* 1960 *to April* 1961—were approved.

(*c*) *R.R.I.C. Kuruwita Sub-station—Progress of work.*—A report submitted by the Director after his recent visit to the sub-station with the Botanist was considered and it was noted that satisfactory progress had been made in the area to be replanted this year.

Agreed that Mr. W. B. Jonklaas be appointed Visiting Agent of the sub-station.

Accounts—December 1960 *to May* 1961.—were approved.

(*d*) *Visiting Agent's Report on Dartonfield Group.*—was adopted subject to the following comments:

(1) *Acreage Statement.*—The Superintendent was asked to get a fresh survey made and to get the original plans revised.

(2) *Machinery.*—The Superintendent was asked to get the advice of the Chief Inspector of Factories regarding provision of guards for engines.

(3) *Weeding.*—The poor weeding at Hedigalla Division was noted and the Estate Superintendent was asked to pay more attention to this work and indicate in his future monthly reports the progress made each month.

(4) *Manufacture.*—Agreed that one day's coagulum from Hedigalla Division be manufactured separately under the supervision of the Estate Superintendent and that a report be given on it.

(5) *Hedigalla* 17½ *acres* 1957.—Agreed with the Soils Chemist's view that Guatemala grass between rows of rubber trees in this clearing be lopped periodically and that it should not be allowed to grow within 8′ of the rubber plants.

4. Reports & Accounts

(*a*) *Receipts and Payments Account for the* 1*st Quarter* 1961.—was approved.

(*b*) *Fixed Deposits.*—A fixed deposit of Rs. 250,000/- placed at the Eastern Bank on 29-6-61 for 3 months at 2¼% was reported and approved.

5. Staff:

(*a*) *Recruitment of staff to State-aided or State-sponsored Boards & Corporations.*—Arising from a request made by the Ministry of Agriculture, Land, Irrigation & Power it was agreed that the Employment Exchange be consulted when recruitment is made to posts with an initial salary of less than Rs. 150/- per month before such posts are advertised.

(*b*) *Assistant & Minor Staff Changes.*—Changes in staff since the last meeting were reported and approved.

(*c*) *Requests from Agricultural Engineer.*—Authority was given for Mr. J. H. Lloyd, who had been selected by the Colombo Plan Authorities in U.K. for assignment as Agricultural Engineer at the Institute, to purchase certain items of equipment required by him and a supplementary vote was passed for this purpose.

6. General Matters:

(*a*) *Panel of Consultants.*—The appointment of Prof. G. E. Blackman, Dr. K. S. Dodds and Dr. G. W. Cooke to the panel of consultants of the Co-ordinating Advisory Committee in London, was approved.

(*b*) *International Rubber Research Conference, Paris.*—Invitations received from the Institut Francais du Caoutchouc, Paris, for the Chairman and the Director to attend the International Rubber Research Conference to be held in Paris from 14th to 18th May 1962 were accepted and authority was given for the Chairman and Director to attend the Conference.

7. Next Meeting.—Agreed that the next meeting of the Board be held in Colombo at 2.30 p.m. on 15th August, 1961.

The meeting terminated at 6.10 p.m.

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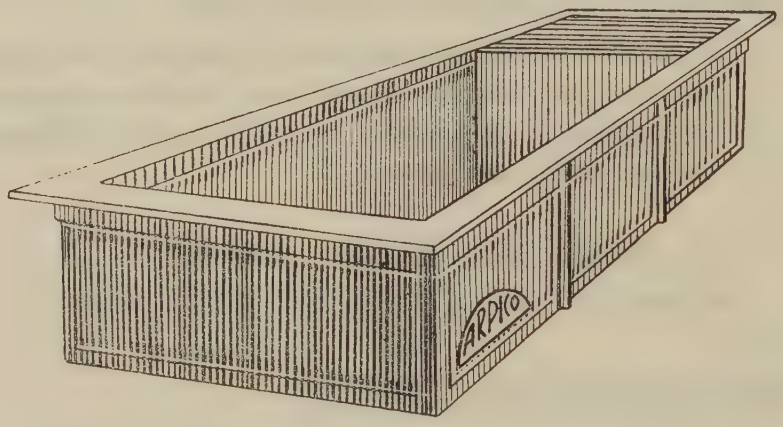

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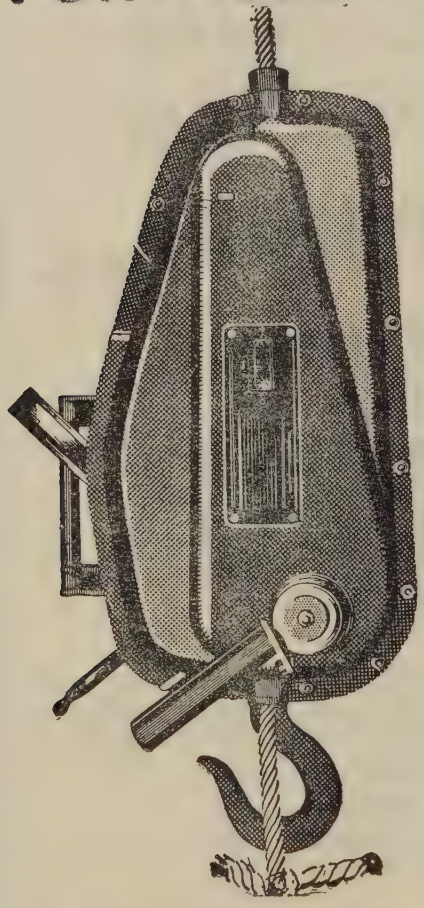

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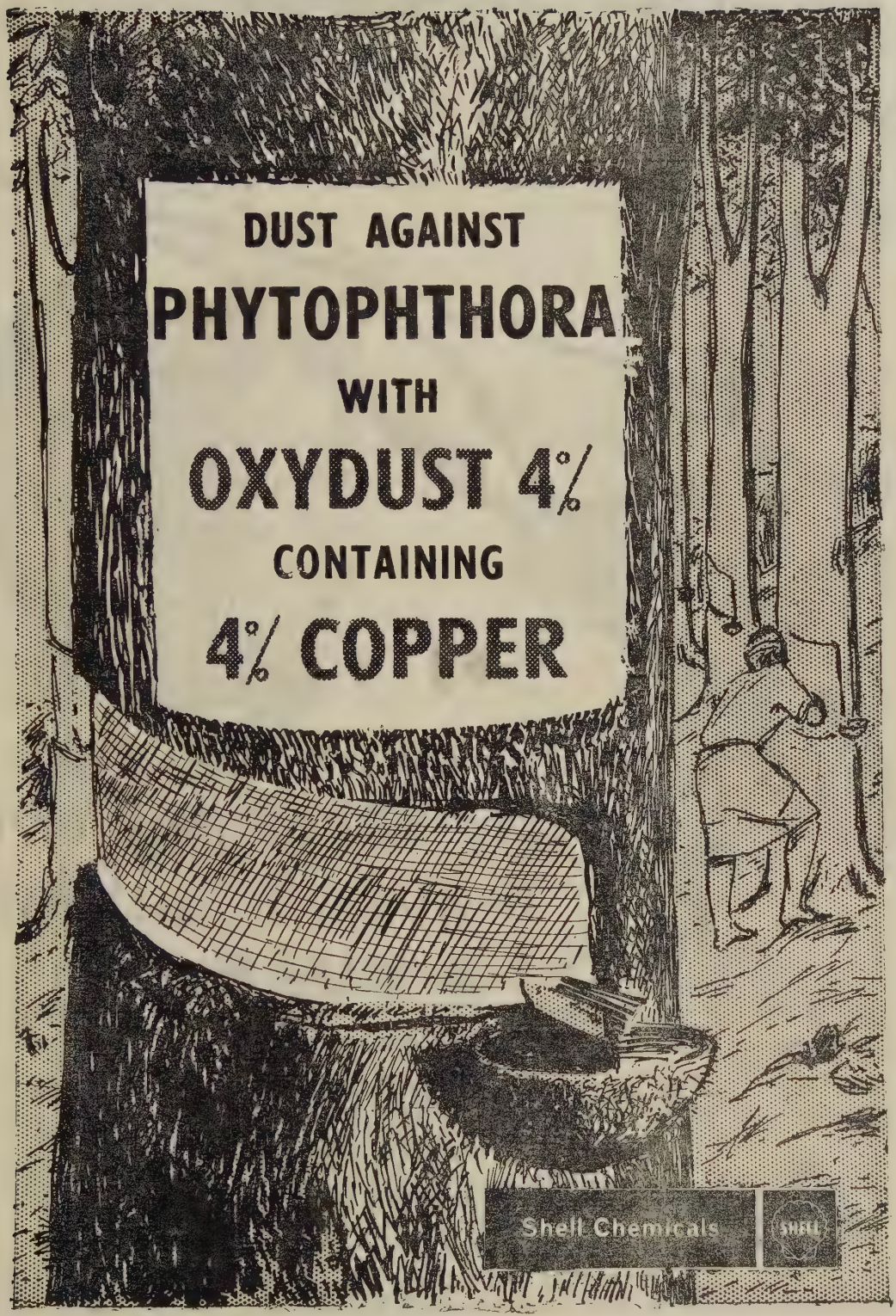
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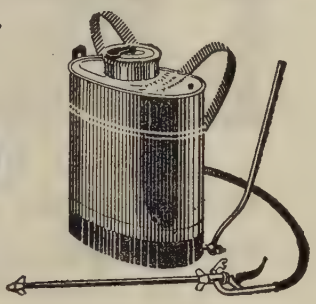

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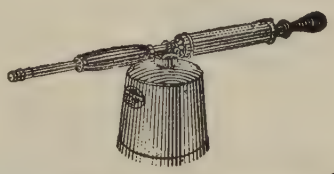

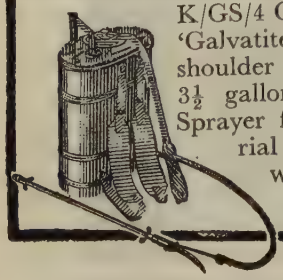

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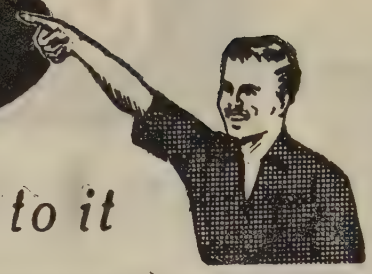

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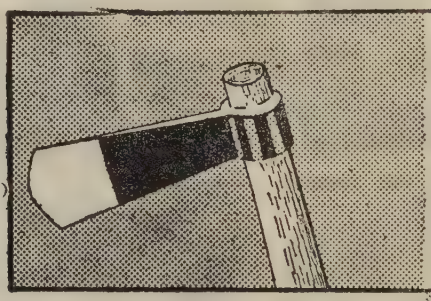

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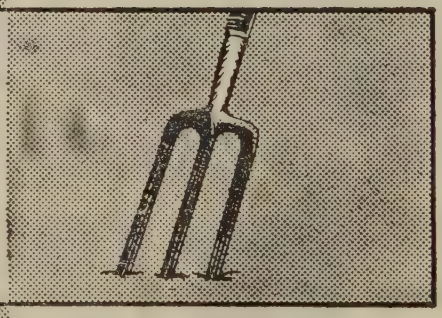

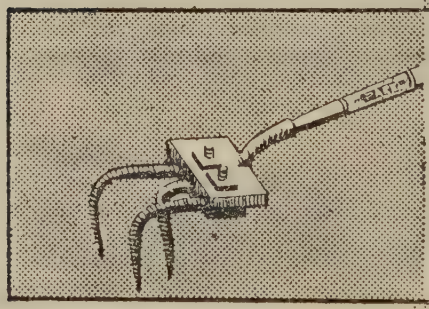

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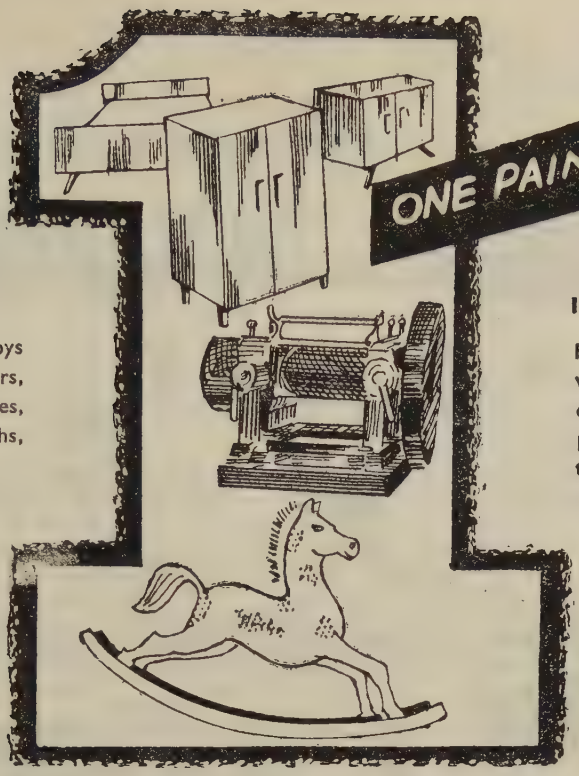

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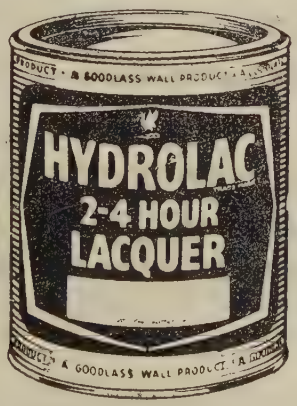

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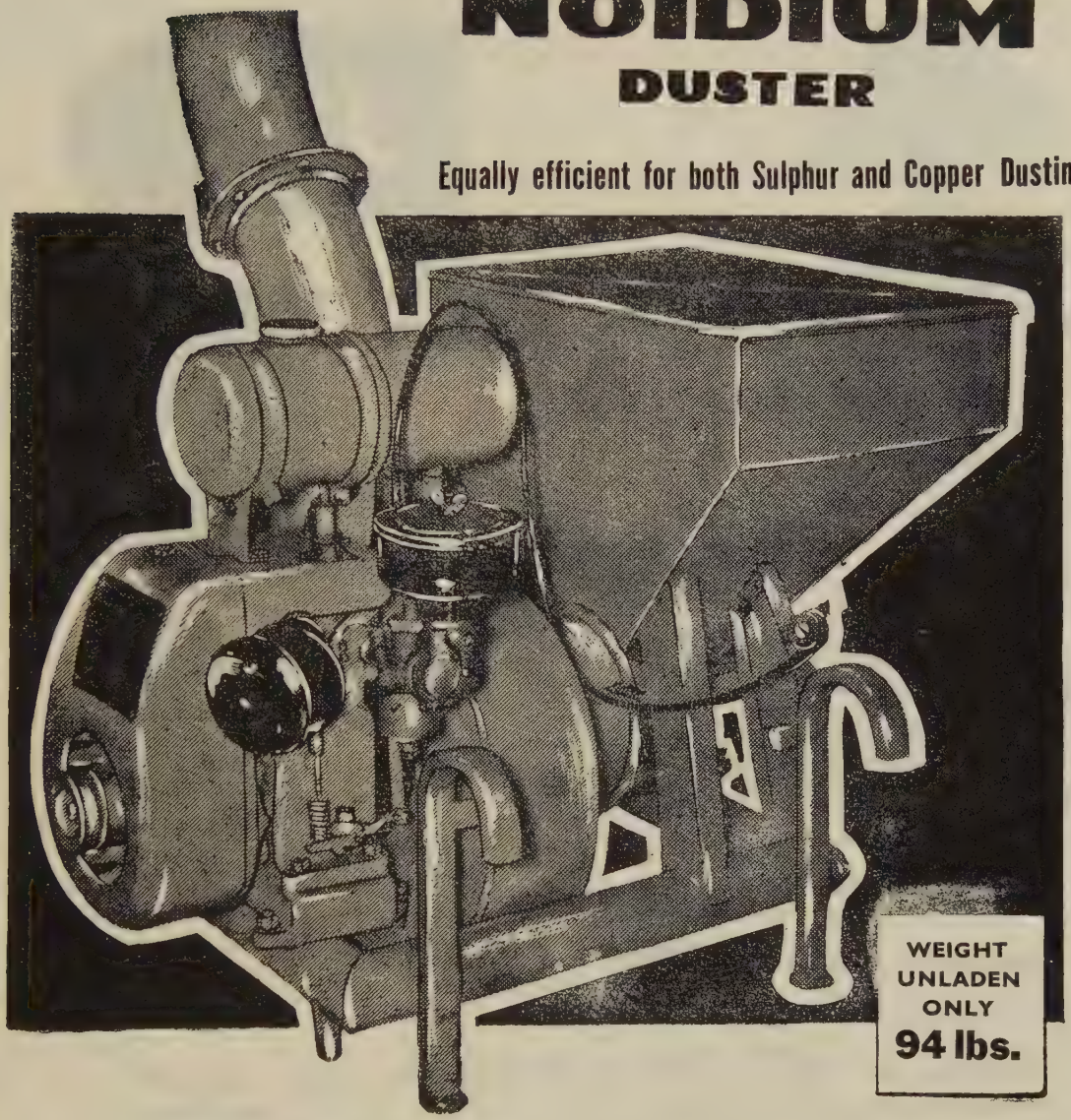

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General's Lake Road, Slave Island, Colombo 2. Telephone: 79351

Simazine 50W

persistent | selective | safe

prevents weeds in RUBBER

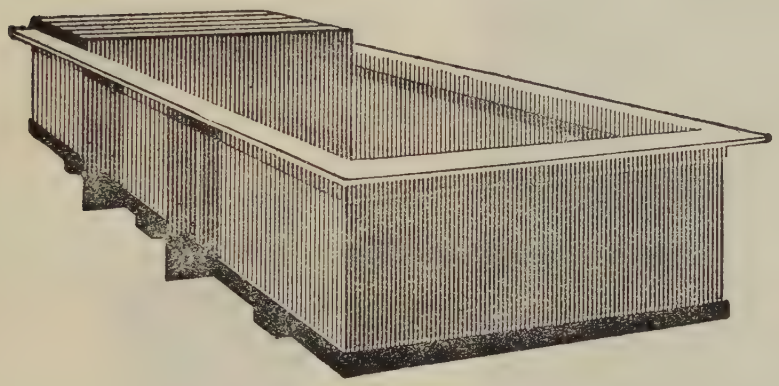
Weed-free rows in immature rubber can be maintained throughout the year with Simazine 50W.
Grasses as well as broadleaved weeds are controlled by Simazine 50W.

Supplies and information from: **FISONS (CEYLON) LTD.,**
P. O. BOX 69, COLOMBO.

FISONS CEYLON LIMITED

DCL

ALL ALUMINIUM COAGULATING TANKS



DCL All-Aluminium Coagulating Tanks are constructed to ensure years of trouble-free service. The shell is formed of one plate of pure aluminium and the reinforcing frame is fabricated from aluminium alloy sections.

DCL Coagulating Tanks ensure.

* Clean uniform sheets
* Substantial saving in time and labour costs
* Saving in equipment, no replacements of pans and other receptacles.
* The minimum percentage of froth sheets
* Saving in factory space

Tanks can be made to your requirements.
The standard capacity range is from 155 to 245 gallons.

Write to us for full particulars and prices

THE COLOMBO COMMERCIAL CO., LTD.

(Incorporated in Great Britain. Liability of Members is Limited)

General's Lake Road, Colombo. Telephone: 79351

CCC886

RUBBER CHEMICALS

Acetic Acid

Rs. 46/00 per 5 gallon polythene carboy.

Formic Acid

Rs. 36/00 per 4 gallon carboy.

Oxalic Acid

Rs. 128/65 per 50 kilo keg.
Rs. 234/00 per 100 kilo keg.

Sodium Sulphite

Rs. 34/00 per ½ cwt. drum.

Sodium Bisulphite

Rs. 27/50 per ½ cwt. drum.
Rs. 50/00 per cwt. drum.

Available ex stock.

CHEMICAL DEPARTMENT

HARRISONS & CROSFIELD, LTD.

MISTRAL II AB

SULPHUR DUSTING MACHINE

NEW — increased power, reduced weight.

LIGHT — 88 lbs. (without handles)—amazingly portable.

POWERFUL — 4 stroke BASCO engine developing 2.75 H.P.

STURDY — solid rigid cast construction cuts down vibration.

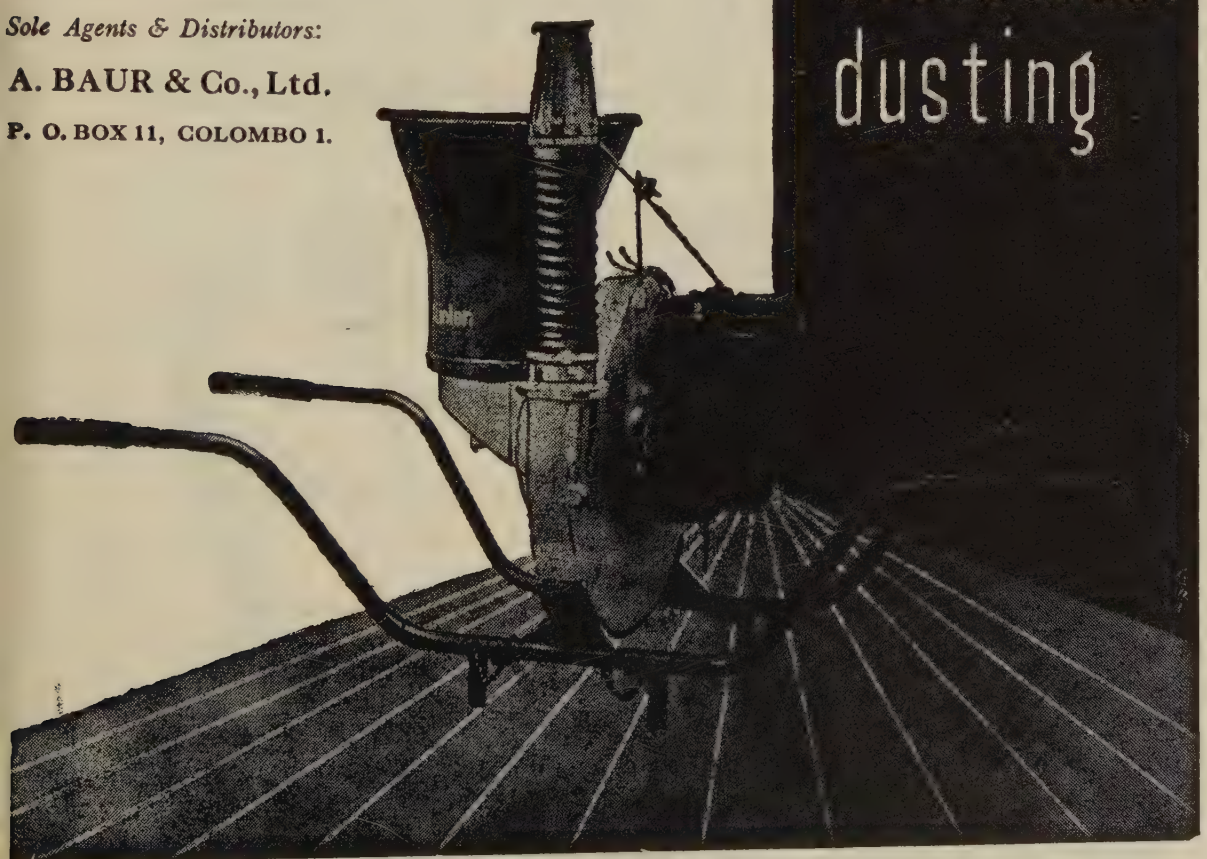
TROUBLE FREE — deals efficiently with lumpy sulphur.

designed for efficient and economical dusting

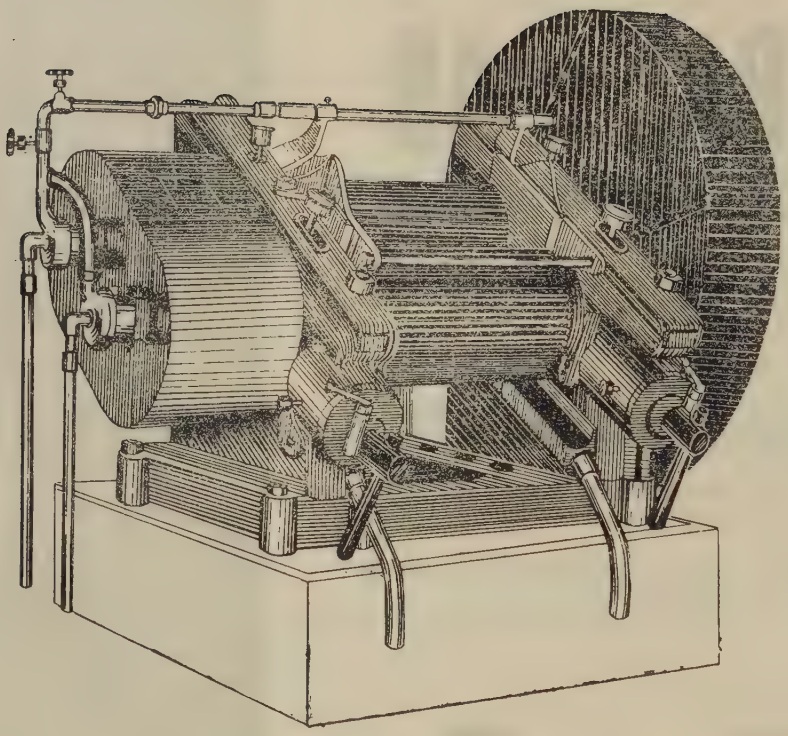
Sole Agents & Distributors:

A. BAUR & Co., Ltd.

P. O. BOX 11, COLOMBO 1.



OPTIONAL EXTRAS:
LIGHTING UNIT
TROLLEY
SPRAYING ATTACHMENT.



C C C 26" x 14" ANGLE TYPE RUBBER WASHING MILL

Low maintenance costs, permanently accurate alignment, and freedom from vibration during even the hardest rolls explain the permanent popularity of the CCC Rubber Washing Mill in Ceylon and Malaya. Over 300 of these machines are in daily use in these two largest rubber-producing countries.

Their immense strength ensures years of trouble free use.

Proved thoroughly efficient for

Macerating. Washing. Creping. Sheeting. Blanketing Sole-creping.

All rolls and driving gear are imported.

We supply any type of internally water-cooled rolls of close grain or chilled cast iron with smooth surface or grooved to any desired pattern.

Consult us for your special requirements :

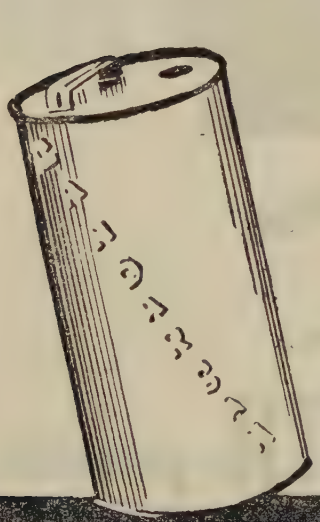
THE COLOMBO COMMERCIAL CO., LTD.

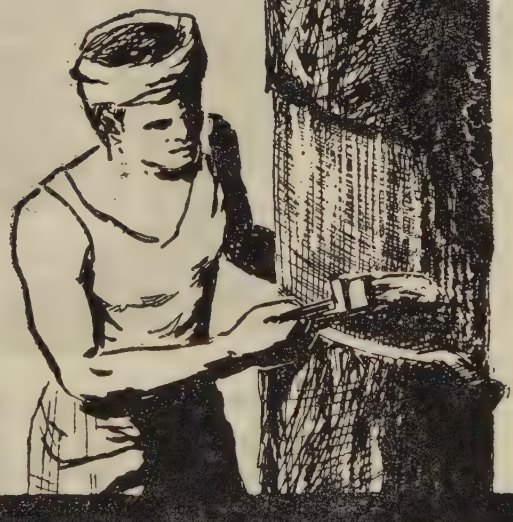
(Incorporated in Great Britain. Liability of Members is Limited)
General's Lake Road, Slave Island, Colombo. Telephone: 79351.

CANDARSAN

The finest mixture for RUBBER TREES

Candarsan is the greatest name in the field of protective and curative mixtures for rubber trees. It is also the cheapest preparation in the market. Candarsan is doubly cheap due to its ease of application to rubber trees. This is because of its great liquidity saving time and labour.

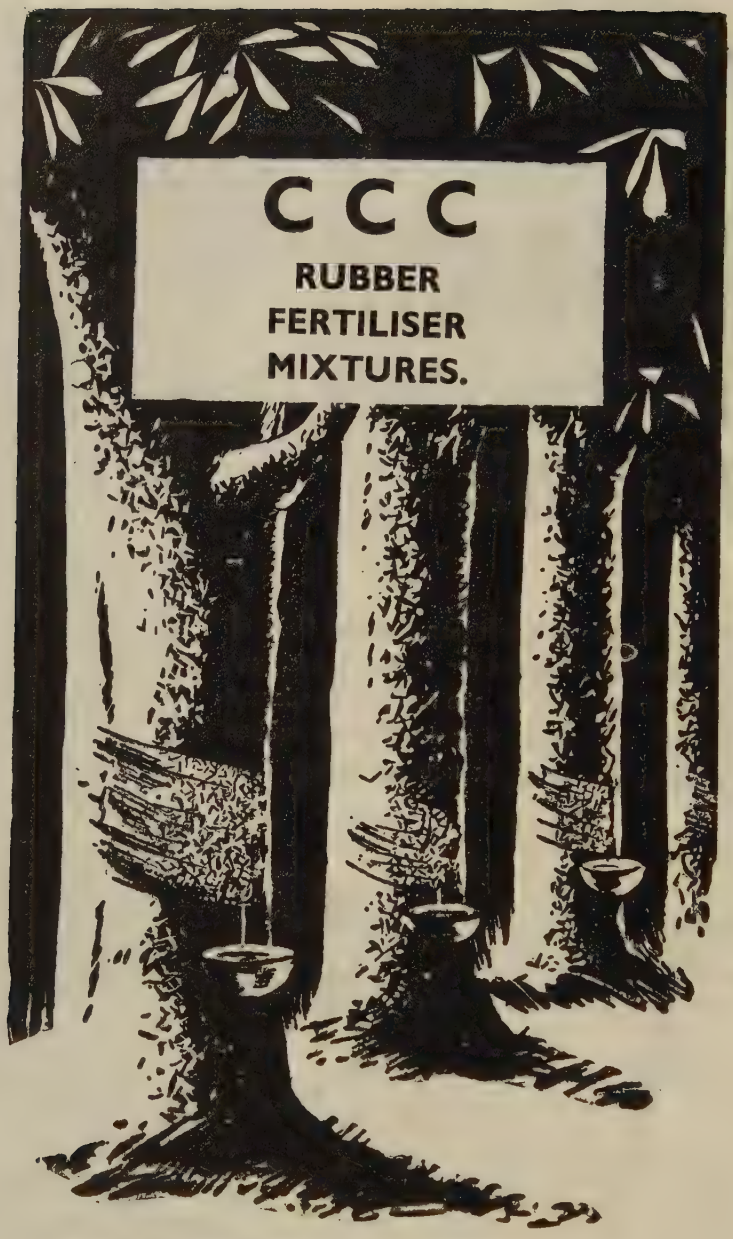




BROWN & COMPANY LIMITED

DARLEY ROAD, COLOMBO 10.

BG/GC/153



FINEST ON EARTH

THE COLOMBO COMMERCIAL CO. LTD.

(Incorporated in Great Britain. Liability of Members is Limited.)

Acland House, Union Place, Colombo 2. Telephone 79351

PERENOX

for control of Phytophthora and Gloeosporium

PERECLOUD

for control of Phytophthora

VERDASAN

for control of bark rot

BUD GRAFTING TAPE

(Permacel)

POLYTHENE RAINGUARDS

Contact :

IMPERIAL CHEMICAL INDUSTRIES (EXPORT) LTD.,

P. O. BOX 352, COLOMBO.

AE-701

"TENACEROS"

CHLORINATED RUBBER PAINT

Made by

BRITISH PAINTS LIMITED

Because of its outstanding resistance to extreme chemical attack and water, ***"Tenaceros"*** *Chlorinated Rubber Paint is widely used in Rubber Factories and for painting Swimming Pools.*

"Tenaceros", *whilst being chiefly protective, offers also a high degree of decorative value.*

SOLE AGENTS

JAMES FINLAY & CO., LIMITED.

COLOMBO

INCREASE YOUR
RUBBER YIELD
WITH THIS NEW
LATEX STIMULANT

"STIMULEX"

PATENT APPLIED FOR

- STIMULEX IS A NEW OIL BASE COMBINATION OF PLANT HORMONES, USED EXTENSIVELY IN MALAYA WHERE IT WAS PRODUCED AFTER 14 YEARS OF INTENSIVE RESEARCH.

- TWO APPLICATIONS OF "STIMULEX" PER ANNUM ON BARK OF RUBBER TREES, BELOW TAPPING CUT, CAN PROVIDE A LATEX YIELD INCREASE OF OVER 20% PER ANNUM.

- PLEASE ASK US FOR COMPLETE TECHNICAL DATA ON "STIMULEX" AND SEE HOW YOUR TREES CAN PRODUCE MORE LATEX AT NEGLIGIBLE COST.

The Ironmongers and Estate Suppliers of Ceylon

HUNTERS

HUNTER & COMPANY LTD.

P. O. Box No. **214.**

Telephone: **5297-9.**